THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

VOL. XX. No. 501—23RD YEAR.] LONDON, DECEMBER 19, 1871. [Subscription per Annum. { 15s. in Advance. 18s. Credit.] DOUBLE No. Price 1s.

RAMSAY'S NEWCASTLE CANNEL
COAL. Analysis—10,000 cubic feet of gas per ton of coal; 26-candle gas; 13¼ cwt. coke per ton of coal.
RAMSAY'S PATENT CONDENSED COKE.
DO. GARESFIELD COKE.

RAMSAY'S FIRE-CLAY ARTICLES.
GAS-RETORTS, introduced 1828. FIRE-BRICK WORKS, established 1804. FIRE-CLAY SANITARY PIPES, CHIMNEY-TOPS, and all Goods made of Fire-Clay. The Fire-Clay is worked from Blaydon Main Colliery, is of excellent quality, and no expense spared in perfecting every article. The FIRE-BRICKS (marked "RAMSAY") are to be seen in all parts of the world, and the Works are the most extensive in the Kingdom.
Manufactories—Derwenthaugh, Swalwell, and Hebburn Quay, near Newcastle-on-Tyne; and London Wharves—Falcon Wharf, No. 80, Bankside; and Honduras Wharf, Cubit Town. Large stocks kept.
Address G. H. RAMSAY, NEWCASTLE-ON-TYNE.

GEORGE GLOVER & CO.,
Patentees of the Standard Gasometers for the Government, and of the
IMPROVED DRY GAS-METERS.

These Meters are warranted to measure correctly and not to vary. Their acknowledged superiority has brought them into general use more rapidly than any Meters hitherto manufactured.
To meet the increasing demand, G. GLOVER AND Co. have just entered on possession of extensive premises adjoining their present Works in Ranelagh Road, and they are now prepared to execute promptly, orders to any extent. They keep in stock all sizes of Meters up to 200 lights. In cases of haste, on the receipt of a telegram early on one day, their Meters can be delivered next day in any part of England, and in the large towns in Scotland.
Particulars and lists of prices forwarded on application to—
RANELAGH ROAD, PIMLICO, LONDON, S.W.;
236, GEORGE STREET, GLASGOW;
OR
15, MARKET STREET, MANCHESTER.

COWEN'S PATENT FIRE-CLAY RETORTS.
JOSEPH COWEN and CO.,
BLAYDON BURN, NEAR NEWCASTLE-ON-TYNE,
Were the only parties to whom a PRIZE MEDAL was awarded at the GREAT EXHIBITION of 1851, for "GAS-RETORTS and OTHER OBJECTS in FIRE-CLAY," and they have also been awarded in the INTERNATIONAL EXHIBITION of 1862, the PRIZE MEDAL for "GAS-RETORTS, FIRE-BRICKS, &c., for EXCELLENCE of QUALITY."
J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts in the United Kingdom; and orders for Fire-Clay Retorts of all shapes and dimensions, Fire-Bricks, and every other article in Fire-Clay, are promptly executed at their Works as above.
COWEN'S GARESFIELD COALS.
Coal Office,
QUAY SIDE, NEWCASTLE-ON-TYNE.

JOHN RUSSELL AND CO.,
THE OLD TUBE-WORKS, WEDNESBURY;
AND
THE ALMA WORKS, WALSALL.
Established at the commencement of Gas Lighting.
WAREHOUSES:
69, UPPER THAMES STREET; COMMERCIAL STREET, SPITALFIELDS; 5, CHARLES STREET, SOHO; and 16, SOHO SQUARE, } LONDON
35, 36, 37, & 39, GRANBY ROW, MANCHESTER.
J. R. and Co. are the original manufacturers of Wrought-Iron Gas Tubes and Fittings, and Inventors of the LAP-WELDED TUBES for Locomotive and Marine Boilers.
J. R. and Co. make all kinds of Tubes and Fittings for Gas, Steam, and Water; Gun-Metal Cocks, Stocks, and Dies; Galvanized Tubes and High-Pressure Tubes, &c.
Lists may be obtained on application to
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JOHN BENT & SON,
WET AND DRY GAS-METER
AND
STREET-LAMP
MANUFACTURERS,
BELL BARN ROAD, BIRMINGHAM.
ESTABLISHED 1830.
All materials found for the alteration of Public Lamps for lighting with the Rod. Regulators with Lava Burners.

BLAYDON BURN AND LOW BENWELL FIRE-CLAY RETORT AND FIRE-BRICK WORKS,
NEAR NEWCASTLE-ON-TYNE.
WILLIAM COCHRAN CARR begs most respectfully to thank the Metropolitan, Provincial, and Continental Gas Companies for their patronage for several years past, and to intimate that he has rebuilt and enlarged his extensive premises for the manufacture of CLAY RETORTS; and that he is now prepared to execute the largest orders with punctuality and despatch. Orders for FIRE-CLAY RETORTS, of all shapes and sizes, FIRE-BRICKS, and all other articles in Fire-Clay, executed on the shortest notice and on the most reasonable terms.
London Agents: JAMES LAWRIE & CO., 63, OLD BROAD STREET, CITY, LONDON.

SCOTTISH CANNEL COAL.
J. & W. ROMANS, Consulting Gas Engineers and Coal Factors of Edinburgh and London, CONTRACT for supplying any quantity of COAL and CANNEL.
They are also Contractors for leasing Gas-Works, for supplying, erecting, or repairing gas apparatus and fire-clay goods.
Messrs. ROMANS, being lessees of several Gas-Works, have their Cannels tested in the ordinary working process, thus securing for their customers a guarantee beyond mere laboratory experiments.
Analysis, prices, and other information will be forwarded on application to their Offices, 8, Forth Street, EDINBURGH; 1, Walbrook, Mansion House, LONDON, or to the "Crown Wharf," Thomas Street, Limehouse, LONDON, where stocks of house, steam, and gas coal are always on hand.
Coal, machinery, fire goods, &c., shipped to all parts of the world.

LESMAHAGO GAS COAL,
AUCHINHEATH COLLIERY,
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JAMES FERGUSON & CO.
LESSEES SINCE 1832.
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LA COUR & WATSON,
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CROLL'S DRY GAS-METER,

PRIZE MEDALS.
LONDON, 1851; NEW YORK, 1853 PARIS, 1855.
(INVENTED & PATENTED IN 1844,)
COMBINING ALL THE LATEST IMPROVEMENTS,
PRIZE MEDALS.
LONDON, 1862; DUBLIN, 1865; PARIS, 1867.
MANUFACTURED ONLY BY
THE GAS-METER COMPANY, LIMITED,
238, KINGSLAND ROAD, LONDON, N.E.

MEDAL AWARDED, EXHIBITION, 1862, "FOR GOOD WORK."
THE IMPERIAL TUBE COMPANY, BIRMINGHAM,
MANUFACTURERS OF
WROUGHT-IRON TUBES & FITTINGS, BRASS & COPPER TUBES,
GALVANIZED & GLASS ENAMELLED TUBES & FITTINGS,
LAP-WELDED IRON & BRASS BOILER-TUBES, ETC., ETC.
Twyere Coils for Blast Furnaces, Boring Tubes, Core Bars, Gun-Metal and other Cocks, Boiler Mountings, &c.
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FOR GAS, STEAM, AND WATER;
STEAM-COCKS, AND ALL KINDS OF GAS-JOINTS.
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FOR GAS, STEAM, AND WATER;
Also **ORDINARY WELDED WROUGHT-IRON TUBES** and **FITTINGS,**
FOR GAS, STEAM, & WATER, EITHER BLACK, GALVANIZED, OR ENAMELLED.
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SILVER MEDAL, PARIS EXHIBITION, 1867.
LLOYD AND LLOYD,
ALBION TUBE-WORKS, BIRMINGHAM,
MANUFACTURERS OF
WROUGHT-IRON TUBES AND FITTINGS
For Gas, Steam, Water, &c.
SOLE LICENSEES AND MANUFACTURERS for the United Kingdom of
THE LAVENANT PATENT ENAMELLED TUBES AND FITTINGS.
LAP-WELDED IRON & HOMOGENEOUS METAL TUBES
For Locomotive, Marine, and Stationary Boilers.
Boiler-Tube Ferrules, Gun-Metal Gland Cocks, Water-Gauges, Whistles, &c.; Stocks, Taps, and Dies for Screwing, and Gas-Fitters Tools of all kinds.
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WILLIAM INGHAM AND SONS,
WORTLEY FIRE-BRICK AND RETORT WORKS,
Near

Leeds.
W. INGHAM and SONS, having for many years been extensively engaged in the Manufacture of
RETORTS AND FIRE-BRICKS FROM THE CELEBRATED WORTLEY FIRE-CLAY,
beg to call especial attention to their RETORTS, which have for many seasons proved to be unsurpassed in quality by any in the Kingdom, their FREEDOM FROM CRACKS and the ADHESION OF CARBON rendering them worthy the attention of all parties interested in the making of Gas.
The Works are of such magnitude as to ensure the prompt execution of orders to any extent.
Estimates for Setting, or Bricklayers sent when required.
GAS OVENS IN SEGMENTS OF EQUAL QUALITY.
A large Stock of Fire-Bricks, Fire-Clay, Terra Cotta, and Drain-Pipes of all Sizes kept in London at Mr. ALFRED WILLIAMS, Wharf, 64, Bankside, Southwark, where all particulars of Prices, &c., may be obtained.
N.B.—*Export orders continue to have prompt attention.*

TRADE MARK.
THE MEDAL FOR 1862.
The only Prize Medal awarded for TUBES & FITTINGS.
CROWN TUBE-WORKS,
WEDNESBURY, STAFFORDSHIRE.
WAREHOUSE: SOUTHWARK STREET, LONDON.

JAMES RUSSELL & SONS, LIMITED,
PATENTEES & FIRST MAKERS OF WROUGHT-IRON TUBES,
ONLY MAKERS OF HOMOGENEOUS METAL TUBES.
MANUFACTURERS OF
TUBES and FITTINGS for GAS, STEAM, and WATER;
LAP-WELDED, LOCOMOTIVE, MARINE, and other BOILER TUBES;
HYDRAULIC TUBES, BEDSTEAD TUBES, WELL TUBES, TELEGRAPH POSTS, COILS, &c.;
GAS-FITTERS TOOLS, VALVES, COCKS, &c.

THOMAS PIGGOTT & CO.,

(Established 1822,)

SPRING HILL, BIRMINGHAM,

MANUFACTURERS OF

TELESCOPIC & SINGLE GASHOLDERS,

CAST & WROUGHT IRON TANKS FOR DITTO;

PURIFIERS, CONDENSERS, SCRUBBERS, RETORTS, VALVES;

IMPROVED WROUGHT-IRON RETORT-LIDS, CROSS-BARS, & SCREWS;

AND GAS APPARATUS OF EVERY DESCRIPTION.

SOLE MANUFACTURERS OF LIVESEY'S PATENT GASHOLDER MAN-LID,

By use of which Man-lid, inlet and outlet pipes can be examined and cleansed without loss of gas in crown of holder, or ingress of atmospheric air.

ROOFS, GIRDERS, BRIDGES, AND BOILERS OF ALL KINDS.

Drawings, Specifications, and Estimates supplied on application.

London Agent: W. G. DAVIS, 2, BRABANT COURT, PHILPOT LANE, E.C.

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ALPHA TUBE & FITTING WORKS

C. & W. WALKER

CONSTRUCT THE LARGEST SIZED

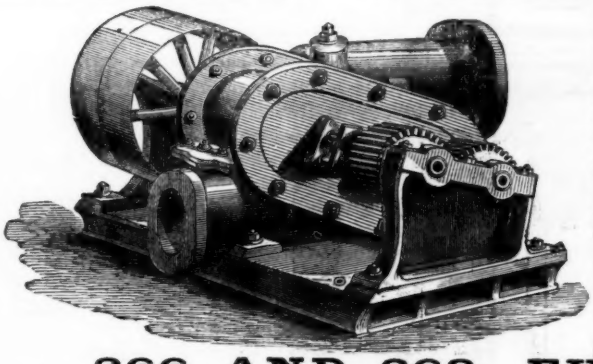
GASHOLDERS, TELESCOPE AND SINGLE-LIFT,

Midland Iron-Works, Donnington, near Newport, Shropshire; 8, Finsbury Circus, London.

LEETE AND EDWARDS,

SOLE MAKERS OF

FORBES'S PATENT ROTARY PUMP,

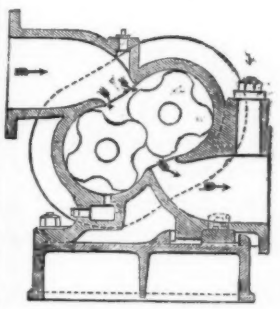


The very best Pump yet introduced for pumping in gas-works, tanneries, distilleries, breweries, water and sewage works, paper-mills, sugar-houses, starch and chemical works, for draining quarries and irrigating land, filling tanks at railway stations, factories, towns, mansions, ships, and dockyards.

In use at several of the largest gas-works in London.

For testimonials and particulars, apply at

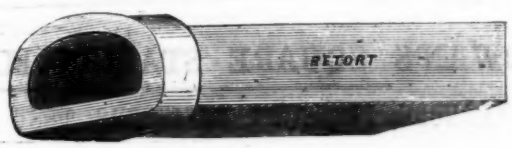
Diameter of Pipes, Suction and Delivery.	Gallons raised per Hour.
Inches.	
2	2,000
2½	3,000
3	4,500
4	7,500
5	12,500
6	18,000
7	24,000
8	31,000
9	40,000
10	49,000
11	59,000
12	71,000
14	96,000
15	110,000
16	125,000
18	160,000



366 AND 368, EUSTON ROAD, N.W.

KING BROTHERS,

STOURBRIDGE FIRE-BRICK AND RETORT WORKS.



KING BROTHERS beg especially to call the attention of Gas Companies to the superiority of their Retorts, which are made from the celebrated STOURBRIDGE FIRE-CLAY. Mr. King has patented a Kiln for burning Retorts, by which Patent all Cold Air is excluded from the Kiln while burning, thus rendering them FREE FROM CRACKS AND CORRECT IN FORM. By great care in Manufacturing, combined with the advantages in burning, a VERY SMOOTH SURFACE is obtained, rendering them less liable to carbonise.

Retort Ovens, Fire-Bricks, Guards, Saddles, Rabbitted Bars, Flues, and Quarries, are all Manufactured of the same quality of Clay.

Every Retort and Brick is branded "King Brothers, Stourbridge."

Agent in Ireland—Mr. JAMES FURNESS, DOCTOR GARDENER STREET, DUBLIN.

THE FARNLEY IRON COMPANY, LIMITED,

FARNLEY, near LEEDS,

Possess special advantages for the prompt and efficient execution of large orders for

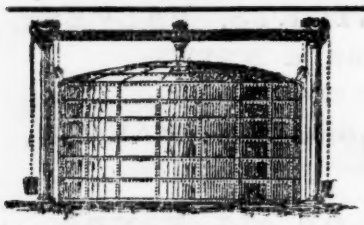
FIRE-CLAY RETORTS & FIRE-BRICKS,

Of every shape and size, and of the best quality; also for their *other productions* in Fire-Clay and Terra-Cotta, including their well-known White and Coloured GLAZED BRICKS.

The F. I. Co. have the exclusive right to make and sell Fraser's Patent "Ribbed" Retorts in Fire-Clay.

Apply as above, or at their Offices,

3, WESTMINSTER CHAMBERS, VICTORIA STREET, S.W., or at 46½, QUEEN STREET, HULL.



IMPROVED GAS APPARATUS,

FOR CITIES, TOWNS, VILLAGES, &c.,

INVENTED AND MANUFACTURED BY

W. C. HOLMES & CO.,

WHITESTONE IRON-WORKS, HUDDERSFIELD.

SOLE MANUFACTURERS of B. W. THURSTON'S IMPROVED SCRUBBER, CONDENSER, and WASHER, in use in many of the principal Gas-Works on the Continent.

PATENTEES of the IMPROVED COMBINED PURIFYING APPARATUS, so eminently adapted for Exportation.

ESTIMATES, PLANS, and SPECIFICATIONS PREPARED for BUILDINGS and APPARATUS.

Prospectus, Price Lists, &c., on application.

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*** *Please address letters to Huddersfield.*

REFERENCES TO NEARLY 300 GAS-WORKS.

WILLIAM & BENJAMIN COWAN,

WET & DRY GAS-METER MANUFACTURERS, BRASSFOUNDERS, &c.

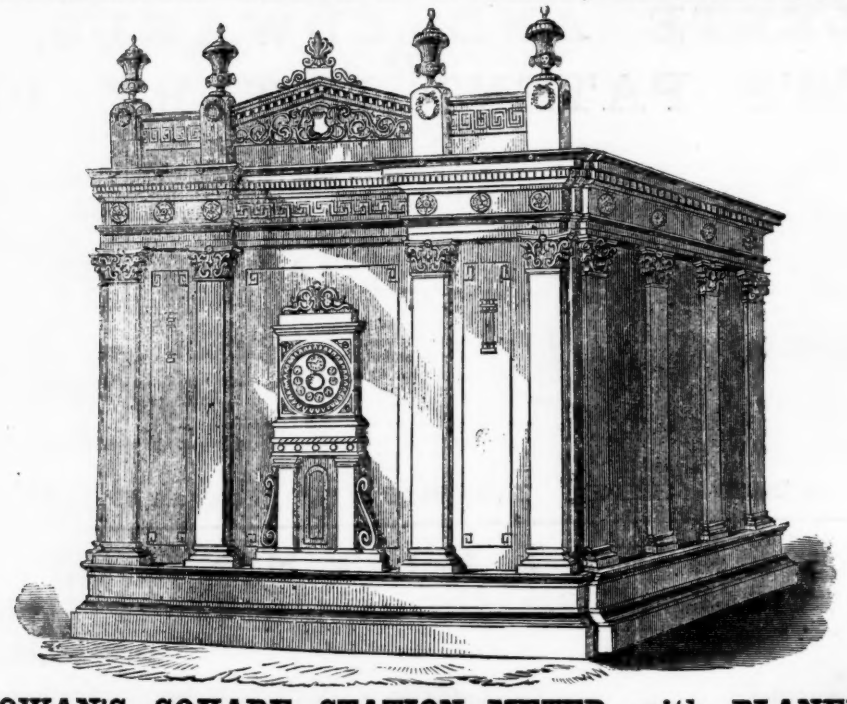
ESTABLISHED 1827.

Sole Manufacturers of ESSON'S PATENT COMPENSATING GAS-METER,

AND OF

COWAN'S PATENT SIDE-VALVE GAS-METER,

BUCCLEUCH STREET WORKS, EDINBURGH.



W. & B. COWAN'S SQUARE STATION-METER with PLANED JOINTS.

GOVERNORS, PRESSURE REGISTERS, TEST GASHOLDERS, GAUGES, &c.

W. & B. COWAN'S DRY GAS-METERS, in CAST-IRON CASES,

Possess a simplicity of construction and facility for repair greater than any yet produced, while the excellence of the material and workmanship, and accuracy of registration, cannot be surpassed. The superiority of their Dry Meters in Tin Cases is also well known, having stood the test of years.

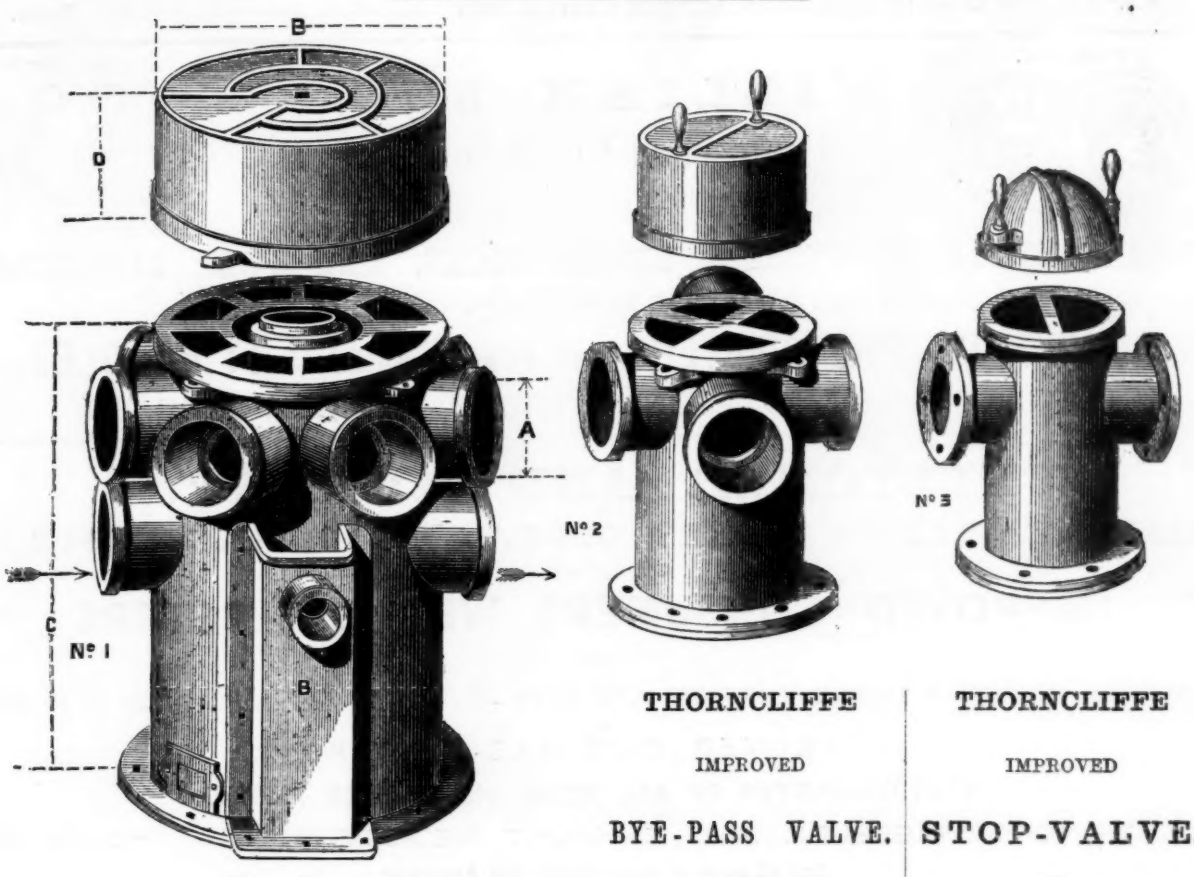
PRICE LISTS ON APPLICATION.

THE THORNCLIFFE IMPROVED CENTRE-VALVE,

MANUFACTURED BY

MESSRS. NEWTON, CHAMBERS, & CO.,

THORNCLIFFE IRON-WORKS, NEAR SHEFFIELD.



Sizes of the

THORNCLIFFE IMPROVED CENTRE-VALVE.

		Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
A	Bore of Pipe...	4	5	6	7	8	9	10	12
B	Diam. of Body.	16	20	23	26	28	31	34	40
C	Height of Tank.	33	35	38	43	46	48	51	56
D	Depth of Cover.	8	9	10	11	12	13	14	16
	Total height...	41	44	48	54	58	61	65	72

THORNCLIFFE IMPROVED BYE-PASS VALVE.

SIZES

From 3 ins. upwards.

THORNCLIFFE IMPROVED STOP-VALVE.

SIZES

From 3 ins. upwards.

In all cases the Covers are cast heavy enough to resist any required pressure.

The advantages derived from the adoption of these Valves are so manifest and cardinal that in the immediate character of the change—the simplicity of the machine—the facility affording for cleaning out connexions between Valve and Purifier—the perfect collection and delivery by suitable overflow of the ammonia, at a greatly diminished depth from ground-line over the old form of Valve—the advantage of connecting on the same level, and at any angle, or opposite to each other, the inlet and outlet pipes without dip or rise—the clear acquisition of space in the purifying-house, by being able to place the boxes nearer together, the new Valve being entirely under the floor—and lastly, though of the greatest importance, the passage of crude and unpurified gas during the change is minimized to the merest fraction, thus preventing the fouling by impure gas the delicate machinery and easily affected exposed movements of the station-meter, thereby preventing the introduction of the enemy (unpurified gas) into the gasholder. Also a dead abutment is offered to all back pressure, imparting thereby to the gauges, governors, and hydraulic seals, a steadiness of action never realized with the once famous, but now fast becoming obsolete, Hydraulic Centre-Valve.

These Valves may be made of any size to suit any position of boxes, to stand any amount of pressure, warranted and tested with gas before leaving the manufactory, prepared to work any number of boxes in rotation—say, two, three, four, five, six, or eight—and for all Valves above 12-inch ports a suitable rack-and-pinion movement is attached if preferred. These Valves (specially arranged) are applicable to inlet or outlet pipes of gasholder, to act as Bye-pass Valves to meters, governors, exhauster, condensers, scrubbers, washers, driers, and duplicate systems of hydraulic main; also to act as Stop-Valves on special mains about the works. Where it is important no impediment be offered to tar or ammoniacal liquor, the same having uninterrupted flow to the general tar-well on the works, and for which purpose the slowly changed, often disordered, and at all times obstructive Slide-Valve (challenging the best of them) is superseded by the exceedingly simple, instantaneously changed Dome-Top Valve, which also carries so marked an index, whether open or shut, at any distance from close observation, providing the Valve can be seen at all. See sketch in perspective, No. 3.

London Office—34, LONDON WALL, MOORGATE STREET, E.C.

JOHN HALL & CO.,

STOURBRIDGE,

MANUFACTURERS of FIRE-BRICKS, LUMPS, & TILES,

AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.

N.B.—A Stock of 15 and 16 in. CIRCULAR RETORTS always on hand. Other kinds made to order on short Notice.

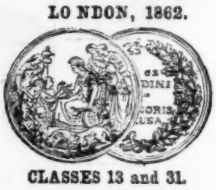
PARIS, 1867.

CLASSES 24 and 53.

WILLIAM SUGG,

GAS ENGINEER.

LONDON, 1862.



CLASSES 13 and 31.

PUBLIC LAMP GOVERNORS, LEVER COCKS, AND POLE LIGHTERS,

LAMP METERS AND BOXES.

LOWE'S JET PHOTOMETERS CAN NOW BE RATED TO 14 CANDLES.

VINCENT WORKS, VINCENT STREET, WESTMINSTER, S.W.

FLETCHER AND MURPHY,

GARRATT STREET WORKS, OLDHAM ROAD, MANCHESTER;

Manufacturers of

IMPROVED CONSUMERS WET GAS-METERS

IN CAST-IRON CASES,

THE UNVARYING WATER-LINE GAS-METER,

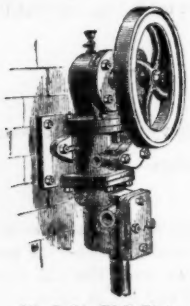
AND

IMPROVED DRY GAS-METERS;

STATION-METERS OF ALL SIZES, with PLANED JOINTS;

GOVERNORS, PRESSURE AND EXHAUST REGISTERS, TEST HOLDERS,

And all kinds of Experimental Gas Apparatus.

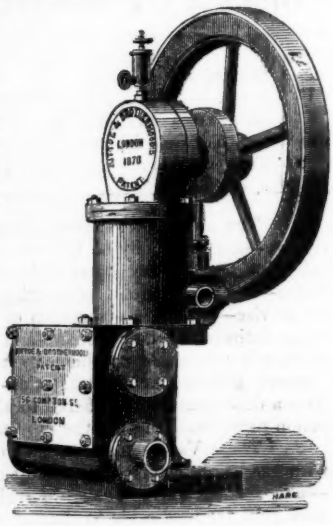


Attached to Wall-Plate.

KITTOE & BROTHERHOOD'S

PATENT

"PARAGON" STEAM-PUMP.



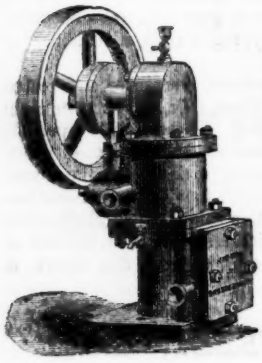
Sizes Nos. 1 to 10 deliver from 75 to 21,000 gallons per hour; the height in feet being equal to twice the steam pressure in lbs. per square inch. Prices from £10 to £90

GAS COMPANY'S OFFICE, LUTON, BEDFORDSHIRE,
Feb. 23, 1870.

Gentlemen,—The Paragon Pump which I purchased of you in 1868 has been in constant use from the date of its purchase to this time, for the supplementary supply of two 8 h.p. steam-boilers. It is in request day and night, and has performed the duties required of it without needing any repairs.

Yours respectfully,

Messrs. Kittoe and Brotherhood. W. PHILLIPS.



MANAGER'S OFFICE, REDHILL GAS-WORKS,
Sept. 3, 1871.

Gentlemen,—The No. 6 Paragon Pump supplied by you has satisfactorily performed the work for which it was ordered—viz., feeding the boiler and pumping up water for the use of the works. In my opinion, it is a very compact arrangement, the working parts are thoroughly enclosed and protected, and the valves are very simply and quickly got at. It is a useful and reliable auxiliary.

Yours truly,

Messrs. Kittoe and Brotherhood. H. T. EVERIST, *Manager.*

FOR FULL PARTICULARS, APPLY TO

MESSRS. BROTHERHOOD & HARDINGHAM,

(LATE KITTOE & BROTHERHOOD AND FORMERLY WILLIAM FOX,)

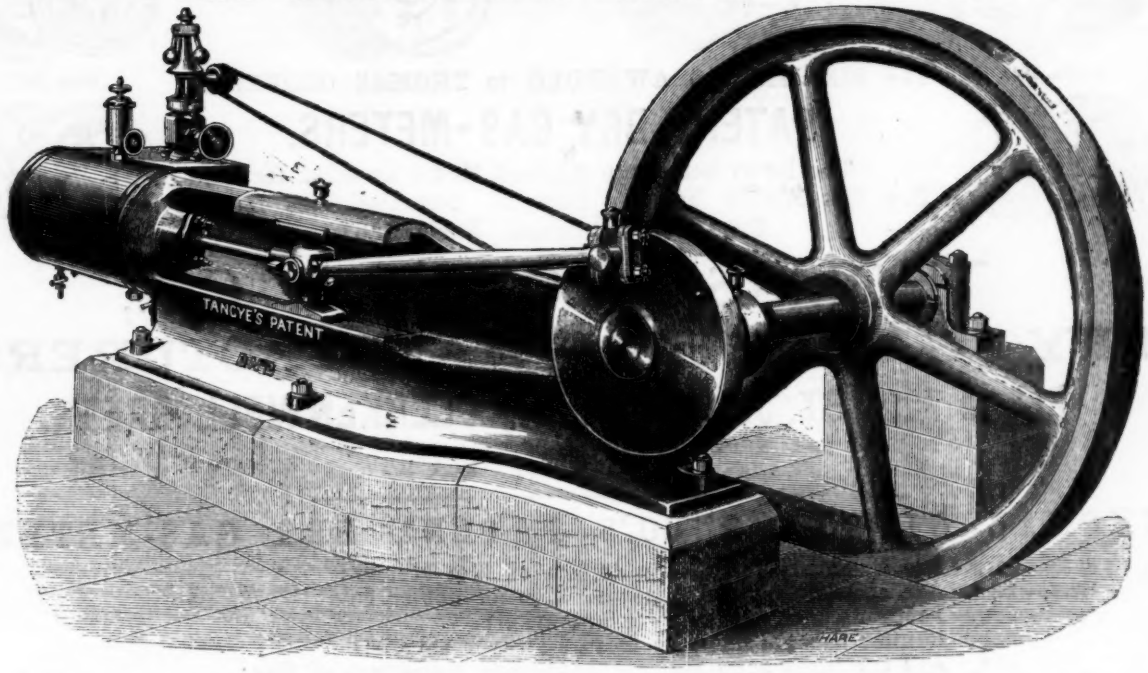
ESTABLISHED 1825.

Manufacturers of Gas-Exhausters, Pumping and other Machinery.

56 & 53, COMPTON ST., GOSWELL RD., LONDON, E.C.

TANGYE'S HIGH-PRESSURE EXPANSIVE STEAM-ENGINES,

WITH TANGYE'S PATENT HIGH-SPEED GOVERNOR.



In this Engine the working parts are considerably reduced in number, as compared with Horizontal Engines generally, rendering it far more durable and compact. The bed-plate, front cylinder cover, cross-head guides, and plummer-block for crank-shaft bearing, are all cast in one piece, the cylinder with its valve-chest being bolted to the end of the bed. The cross-head slippers and connecting-rod ends are made adjustable, so that any wear can be readily taken up. The fly-wheel, cylinder end, connecting-rod, and crank-plate are all bright. All the parts are made to Whitworth's gauges, and the material and workmanship are of the highest class throughout.

The Governor is of a very special description, and combines, in the small space usually occupied by the ordinary steam stop-valve, a governor, throttle-valve, and stop-valve complete. It is exceedingly sensitive, simple, and compact.

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NUMBER	A	B	C	D	E	G	H	J
Indicated horse power, at 50 lbs. pressure in Boiler, speed 240 feet per minute, cut off at Half-stroke	2·1	3·8	5·9	8·6	15·0	19·4	23·9	34·5
Price of Engine	£27 10	£32	£38 15	£46	£70	£90	£110	£130
Feed Pump, with Gun-Metal Working Parts, EXTRA.	....	£3	£3 15	£4	£5 10	£6	£7 10	£8
Price of Engine complete, with Feed Pump and Cornish Boiler and Fittings	£52*	£65*	£94	£114	£156	£190	£230	£255

MORTON'S PATENT SELF-SEALING RETORT-LIDS,

WITH HOLMAN'S PATENT ECCENTRIC FASTENINGS.

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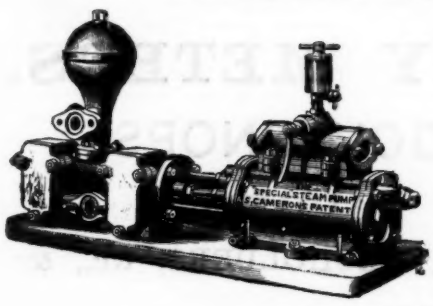
THE "SPECIAL" STEAM-PUMP

IS THE

BEST PUMP FOR PUMPING AMMONIACAL LIQUOR, TAR, AND WATER IN GAS-WORKS.

AND THEREFORE ADOPTED IN THE FOLLOWING AND OTHER GAS-WORKS:—



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Dublin Consumers Gaslight and Coke Company.
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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

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THE JOURNAL OF GAS LIGHTING, WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, DECEMBER 19, 1871.

Notes upon Passing Events.

The dangerous condition of the Prince of Wales—a personage of the highest rank, surrounded, in popular opinion, with all the appliances that can make life safe, easy, and happy, and yet poisoned by the effluvia of a drain—cannot fail to draw—it has already drawn—the full current of public attention to the sanitary condition of our ordinary dwellings. Out of a great public calamity good may, nay, must arise, if the internal arrangements of houses are brought back within the region of simple science and common sense. To travel over all the subjects involved in securing the population from the poisonous gases manufactured in water-closets, cesspools, and sewers, would fill a volume. We must confine ourselves, in the present instance, to one or two obvious points. There never was a greater sanitary mistake than the mania for multiplying water-closets that prevails with well-to-do people, and especially with certain schools of sanitarians. In some instances, in towns with scarcely the population of villages, open privies have been forcibly suppressed, and water-closets substituted. We cannot too often repeat that for ordinary working people, unless subject to the daily visits of a scavenger, a water-closet is the worst and most dangerous arrangement—it never is in good working order for a whole week. But the case is not much better in country mansions not occupied for the whole year round, not within easy access of a skilled mechanic, and probably fitted up, in the first instance, in situations not originally intended for anything of the kind. Two instances have lately come within our knowledge of the disastrous effects of ill-arranged closets and cesspools in mansions of a very high class. In one instance, a husband, wife, three children, and several servants died, poisoned by a well into which the cesspool of a water-closet filtered, and this in a splendid shooting-lodge in the highlands of Scotland. In the other, an ancestral manor-house in the midland counties, a fever broke out and prostrated all who slept in the best bed-rooms, to every one of which there was a water-closet. On investigation, the whole sewer system was found choked. We have not the slightest doubt that in all situations where it is impossible to convey the sewerage with a good fall far away from wells or springs, it is much better to adopt the earth-closet system in a house, and open privies out of it. As to wells, however old, however excellent by reputation, they should be examined as carefully as if they were intended to hold wine instead of water. As to villages and small towns, to sacrifice the manure by dilution with water, save where exceptional facilities are afforded for sewage irrigation, is the rankest folly, for it is to part with a valuable article and create needless danger of fevers of the more virulent types. As a matter of course, the usual nonsense about ventilating sewers has been talked and written. It has had the good effect of bringing out the following exhaustive letter from Mr. William Haywood, addressed to *The Times*, a journal which everybody cannot afford to read, and which, in the face of the Tichborne trial, the daily contemporaries will scarcely afford or condescend to copy:—

Sir,—We may expect in your columns to see many suggestions for improving the ventilation of sewers. Already such have appeared, and, with the view of saving trouble to some writers and time to your many readers, I crave space for a few words in answer to Mr. W. H. Gibbs.

It is popularly thought that a system of sewers resembles a mine. Now, both are subterranean channels; but there the resemblance ceases, and in the conditions affecting their ventilation they are essentially different.

A mine consists of a series of passages generally of about the same sectional area. Whatever their length may be, they are carefully adjusted with the view specially to transit and ventilation; there is ordinarily but one entrance to a mine, or if more, the mine is divided so as in respect of ventilation practically to form distinct mines; and whether the ventilation be by natural or artificial means, there is but one downcast shaft for the entrance of air, and one upcast shaft for its exit.

Whatever, therefore, may be the length of channel in a mine, and however much the air currents in them may be turned, divided, and reunited (and this is largely done), the quantity of air set in motion neither loses nor gains materially on its passage; practically that quantity which goes down comes up, and no more; thus, the ventilating power can be calculated, and within the limits of the power the quantity of air can be diminished or increased according to exigencies.

The sewerage of a town consists of tubes varying from three inches in diameter to others a hundred times that capacity, and in London even from three inches to 13 feet in diameter. They are laid with various directions, inclinations, and levels, and at every 50 feet at least of their length is a gully, sink-pipe, water-pipe, or other inlet, all of which must admit water through them, and most of which at times do, although they should not, admit air to escape through them. In 1858, when Dr. Letheby and myself investigated this subject, we found that within the City of London alone there were 260 miles of drainage channel and more than 47,000 inlets to them.

Under existing conditions sewers, therefore, are but tubes perforated with air-holes at intervals along their entire length, and the application of air-exhausters would be practically useless, for wherever placed the air currents would rush in with great velocity towards them from the nearest inlets, the current becoming feebler and feebler from other inlets, as the distance increased, until the exhausting power would no longer operate at all.

This has been the subject of inquiry by committees of Parliament and others for 40 years past; experiments have also been made which only demonstrate that which engineers who have studied the question knew perfectly well beforehand—that until absolute control over every inlet to the sewers can be obtained, ventilation by such means as those suggested by Mr. Gibbs is impracticable.

The Mr. Gibbs referred to proposed to procure an artificial current of air through sewers by means of the fan machinery with which he has successfully dried hay and corn in wet seasons.

The battle of the styles is again raging over the new Law Courts. Mr. Street has published his design for the Strand front, and we cannot hear of any one who likes it. Into a quarrel in which such great authorities are engaged we will not venture to enter. We will not assert that a Gothic building may not be so designed as to be appropriate for any purpose; but having admired Mr. Gilbert Scott's picturesque St. Pancras Station, we venture to ask whether any one engaged in reading and writing all day would willingly adopt the many narrow and ornamental windows which so much contribute to the beauty of the Euston Road front.

In the December number of the *Journal de l'Agriculture*, we find the following picture of rural England from the pen of that eminent author and chemist, Mons. J. A. Barral. It will neither satisfy that class of agricultural agitators who are always calling for a King Stork in the person of a Minister of Agriculture, or those Republican Utopians who can see no happy future for our rural population until we have followed the example of unquiet France—shaved the earth clean of anything like resident landed gentry, and reduced the average of farms to little plots, cultivated by a thrifty, industrious, ignorant, and selfish peasantry, to whom all tyrannies are equally welcome as long as they are permitted to sweat in peace and save farthings over their hardly won acres.

"One of the causes of the misfortunes of France is the neglect "of the interests of agriculture. In England, where the progress "of agriculture is greatest, and the pursuit most profitable, "Ministers of State, Members of Parliament, and men of influence "of all classes are continually occupied in promoting those "measures which will secure the liberty of agricultural trade "and the development of its resources, resisting heavy taxa-"tion of the soil and its products, encouraging education "amongst the rural population, improving the condition of "roads and cottages, and, in fact, in every way endeavour-"ing to introduce into the country the amenities of urban life,

"The revenues of England are largely raised by the taxation of a "few articles, chiefly of foreign import. The British military "system does not withdraw a large mass of labourers for long "years from the cultivation of the soil. The men who acquire "large fortunes invest their capital or disburse their income not in "the factitious splendour of city luxuries, but near villages where "the school-house and the church receive continual donations, so "that the rural population may not be deprived of intellectual life." This picture, it must be admitted, is rather too flattering, though true in the main. The grievous mistakes in our rural condition are under discussion, and are subjects of the anxious thoughts of able and independent men. In France the peasant proprietor, on condition that he is allowed to labour in peace, is content to be castrated of all political power, and to leave the destiny of the nation to be haggled for by a succession of adventurers, brilliant and eloquent, or fierce, audacious, and unscrupulous, but without a "stake in the hedge."

A lesson on the condition of British agriculture was presented during the week of the Smithfield Club Cattle Show for the instruction of every one who had eyes to see and the wit to draw an inference. More than an acre of space was covered with samples of machinery and implements entirely employed in agriculture. It may safely be asserted that when the Smithfield Club was founded in 1798, there were not more than half a dozen men who dreamed that British agriculture would eventually rest on the skill of British mechanics. Fifty years later, farmers clubs were still discussing the advantage of horse and steam machinery, and asking what was to become of hand labour if the flail that cost eighteenpence, and was wielded by a labourer at eighteenpence a day, was superseded by a threshing-machine. Until the International Exhibition of 1851, no threshing or mowing machine had ever been seriously considered by the British farmer; and it was at least ten years later that that same slow but sure individual began to believe that there were considerable benefits to be derived from steam power as a substitute for horse power in the cultivation of the soil. The year 1871 "saw another sight." The mere fact that a series of firms appeared at the Smithfield Club Show, who had all risen from humble station and small means—some with the traditional half-crown and tinker's cart, some from humble mechanical employments, some from behind the counters of country shops, and each representing factories where hundreds, thousands of men were employed merely to supply the machinery and implements required by ordinary tenant-farmers—proclaimed a revolution. The drill is an implement as old, to say the least, as the great Whig aristocrats who consoled themselves for the frowns of George III. by smiling harvest homes. But thirty years ago it was a curiosity in many countries. You met rival drills at every step in the galleries of the Agricultural Hall, with all the appliances for distributing modern chemical manures with the seed. Alongside was the inevitable horse hoe to clear the weeds from the regular rows of the drill. At considerable expense half a dozen makers competed with the horse-driven reaper of corn and mower of grass, so lately a curiosity, now as much a matter of course on a well-managed farm as a cart. Following the horse-mower come the horse-driven rakes and hay-makers, which, with their iron teeth, to spoil the picture in Thomson's "Seasons." Passing over a multitude of small but useful agricultural appliances, we descend the stairs, where, according to due order, we ought to have commenced. There we find elephantine steam-engines, stationary and locomotive, brought at vast cost from Leeds, Lincoln, Bedford, Ipswich, Grantham, and Maidstone; some used for the steam cultivation of the soil by at least three different processes, others for driving the wonderfully perfected threshing and other machinery. In thus skimming the cream of the mechanical progress of agriculture within our own generation, and most markedly within the last twenty years, we must draw attention to the fact that the improvement in operations has been of necessity accompanied by an improvement of the condition of the working men. Not only has all the year round employment been created for mechanics of a superior class in purely rural districts, but on every farm where the best machinery is employed a demand arises for more skilled, and consequently better paid, labour. Thus machinery does good in every way—secures and quickens work, makes the farmer more independent of seasons, soil, and climate, and, above all, makes the labourer a more active and more intelligent being. The weak point of our agricultural system is at the same time made more prominent by the increased employment of machinery, by the inevitable demand for intelligent education.

A great work has been finally accomplished by the purchase of Hampstead Heath—four hundred acres of ground as picturesque in its way as anything in England. The transaction has been throughout creditable to all concerned—to the Metropolitan Board, for its vigour and decision; to the vendor, Sir Thomas Wilson, for his unlitigious spirit and liberal terms. We trust that the landscape gardener employed by the Board will not make too much of a garden; that, preserving and encouraging its wild beauties, plenty of room will be left for the games of the poorest part of the population; that, donkeys and goats, with well-behaved owners, will not be absolutely excluded; and that horsemen may again find the gallops once so delightful, now absolutely dangerous. The holes made by sand-diggers need not be all filled up; in some instances they will afford opportunities for picturesque combinations in planting. A good deal may be made of the ponds, which, properly screened by evergreens, reeds, and grasses, might be turned into capital bathing-places. Epping Forest is a very desirable outlying Park, but Hampstead Heath is easily within reach of all London. To drain it thoroughly is the first and essential operation, and will cost some thousand pounds. Wherever it is possible, the drain water should be carried to the existing or other ponds. We have sub-tropical gardens and specimens of bedding-out in perfection in Battersea, Victoria, and Hyde Parks. Would it not be well to let some one like Mr. Robinson try his hand at a "Wild garden" and a Spring garden?

Mr. Bailey Denton took the appropriate opportunity of the Cattle Show week to read before the Society of Arts a paper "On Sewage as a Fertilizer of Land, and Land as a Purifier of "Sewage," which we give in full in another place, and commend to the notice of those who have no fixed preconceived notions on the subject, and desire to know the mature opinions of such practical, scientific, and experienced authorities as Mr. Denton, Dr. Voelcker, and Mr. William Hope. The conclusions at which these gentlemen arrive are that sewage may be rendered perfectly innocuous by application to soil naturally fitted by its quality and porousness, or artificially prepared for the purpose; that an important, if not essential, condition is to employ sewage as much as possible in growing a succession of appropriate crops; that soil may either be employed with the direct view of carrying on a profitable farm, in which case the extent may be as wide as possible, or as a filter-bed for purposes of deodorization, in which case the sewage excreta of a very great city may be poured on a comparatively limited filter-bed; and that all the attempts to manufacture a profitable portable manure out of liquid sewage are delusions, maintained by arguments equal in value to those that may be urged for prayers to the African deity, Mumbo Jumbo! Mr. H. S. Thomson, chairman of the Journal Committee of the Royal Agricultural Society, opened the proceedings in a short address, in which, as an amateur chemist of considerable pretensions, he managed to make a blunder which would have been passed over in the Society where he reigns despotically, but which was pitilessly dissected at the Society of Arts by Dr. Voelcker in the following important passage:—

> The chairman had alluded to the fact that the soil possessed the marvellous power of absorbing ammonia, and retaining the fertilizing ingredients, such as phosphoric acid and potash, which were the most important. It should also be borne in mind that whilst the land possessed the power of retaining a certain amount of ammonia, this power was not only limited, but the ammonia was rapidly destroyed, and became changed into nitric acid, which was eliminated in the drainage that flowed from the land, and so was lost; so that there were no means of storing up in the soil any large amount of ammonia. If they wished to obtain the maximum value from the nitrogenous constituents contained in the clear liquid of sewage, they must endeavour, therefore, to grow crops whilst the sewage was in the land.

The Great Bashaw of the Royal Agricultural Society thus presented one more illustration of the line, "A little learning is a dangerous "thing." On the two modes of employing sewage, the following passages from Mr. William Hope's speech are very important:—

> The land would not take the sewage of more than from twenty to twenty-five persons per acre, and after two years experience his belief was, it was impossible to get the value from the sewage of more than twenty persons per acre, for it was very easy to overburden the market with garden produce, and the bulk of manure, therefore, must be converted into more portable produce, such as cereals. He believed that the bulk of the sewage would be so used in a few years time. From perhaps Sept. 1 to May 1, sewage might be applied to cereal crops with advantage. In the earlier part of the time it might be used to produce a crop of mustard, which would afterwards be ploughed in, and there was no better preparation than that for wheat. At a later period it might be applied directly to the wheat; after that, again, to fallow land in preparation for either wheat, barley, oats, or beans. Then, again, in spring it could be applied to cereals sown in the autumn which did not receive any sewage at that time. In this way they would get the greatest return with the minimum of outlay, and at the same time the minimum of uncertainty as to a market. . . . With regard to the remarks about Birmingham, he had recommended what was practically the same scheme as he had formed many years for London—a small area of land as a sort of filter at the end of a culvert, with the power of selling the sewage to farmers right and left. He was now about to lay out for the Corporation of Birmingham about a thousand acres for the intermittent filtration of sewage, amounting to a daily average of about 16 million gallons. On his farm at Romford, in last June, December, and January, he had applied 6000 tons an acre continually to a portion of about seven acres, and the result was perfectly satisfactory, although the land had not been so thoroughly drained as it should be for such a purpose. This was at the rate of about 31,000 tons per annum per acre, and the 16 millions of gallons in Birmingham would be about the same proportion when applied to 1000 acres. Consequently he did not apprehend any danger from the operations proposed to be carried out there.

The management of the sewage of towns is gradually passing into the hands of persons who unite experience as sewage farmers with attention to engineering details. In a few years sewage farmers will exist as a class, and the mere quacks will be elbowed out. Practical experience is as much required in sewage farming as in steam cultivation—a union of the farmer and the engineer.

Since the appearance of our last "Notes," we have again studied the new West and East street junction and improvement projected by the Metropolitan Board. There can be no question that every widening of streets and bursting across the lines of thoroughfares must be a good work in London, but although this idea is in the right direction, we cannot think it is well designed for relieving the dock traffic. As far as Old Street, where the traffic cannot be very considerable, there will be no great expense; but where Clerkenwell is crossed, there is a terrible bend, so that dock wheeled traffic desiring to cross Blackfriars Bridge or get into Holborn without passing through the City must make a long arm to the north. We dare say that in committee the witnesses for the Metropolitan Board will be compelled to admit that they would much rather have pierced and relieved the crowded thoroughfares of the City, but dared not encounter the opposition of the Corporation. In the meantime the Corporation are sunning themselves under the pleasant idea that the grand plan of a street from the east end of Holborn Viaduct, through Christ's Hospital, and straight on through Moorgate Street and Houndsditch, estimated to cost a million, will be made without costing the City a farthing. This idea is based on the scheme of the Mid-London Railway. This is to start underground from the Marble Arch, and, passing behind and under one side of Oxford Street and Holborn, cross the Viaduct, unite with the projected central station of the London, Chatham, and Dover, and proceed through Christ's Hospital forward, making the before-mentioned new street to Moorgate Street, and obtaining a subsidy of half a million from the Metropolitan Board. Nothing can look better on paper, and it is to be hoped that the capital may be found for an improvement which would render at least half the Metropolitan Board scheme unnecessary.

The Rector of Bishopsgate has sketched out, in a letter to *The Times*, a scheme which the master-wardens, vice-wardens, chaplains, providitors, and rector-wardens of the City Companies must look on as nothing less than sacrilegious; and from a parson, too, who is expected to respect everything that is old, however moth-eaten, rusty, hideous, and useless. The Rev. William Rogers desires to multiply middle-class schools within the whole circle of the metropolis, with "provisions for teaching "science in relation to those technical subjects which are "the foundation of commerce." With this view he proposes to beg the holders of the various charitable trusts connected with London and its suburbs to give up the funds which now in so many comical ways afford them patronage, amusement, employment for fussy committeemen, and last, although not least, luncheons and dinners where self-praise and mutual admiration are the order of the day. But Rector Rogers, although he begs, also threatens, like the mendicant who asked alms from Gil Blas with a blunderbuss pointing over the hat. Here is his blunderbuss, in an extract from the Endowed Schools Act:—

In case of any endowment which is not an educational endowment as defined in this Act, but the income of which is applicable wholly or partially to any one or more of the following purposes—namely, doles in money or kind, marriage portions, redemption of prisoners and captives, relief of poor prisoners for debt, loans, apprenticeship fees, advancement in life—*or any purposes which have failed altogether, or have become insignificant in comparison with the magnitude of the endowment*, if originally given to charitable uses in or before the year of our Lord 1800, it shall be lawful for the commissioners, with the consent of the governing body, to declare, by a scheme under this Act, that it is desirable to apply for the advancement of education the whole or any part of such endowment, and thereupon the same shall, for the purposes of this Act, be deemed to be an educational endowment, and may be dealt with by the same scheme accordingly; provided that in any scheme relating to such endowment due regard shall be had to the educational interests of persons of the same class in life, or resident within the same particular area as that of the persons who at the commencement of this Act are benefited thereby.

This is a hint that, in a future session, *may* may be converted into *must*. What a prospect for the distributers of loaves, sixpences jingled on a tombstone, half-crowns in purses, marriage portions in parishes where servant maids have ceased to be born, suits of clothes indiscriminately distributed, and that total waste that forms the excuse for so many dinners by Ring and Brymer and the Albion Tavern Company, Limited! There is the Clothworkers Company, which, with unexampled courage, is going to Parliament for leave to build a new church, and pull down the deserted Lambe's Chapel, with special reserved seats for the dignitaries of the Livery and their pensioners "all in a row." Did the promoters of this Bill contemplate the cross-examination to which their law officer may be subjected by Professor Fawcett in the Lower, or Lord Lyttelton in the Upper House? For Parliament has long since agreed to call what the City Companies term "confiscation," "equitable distribution."

Circular to Gas Companies.

If we are to judge from the sensational advertisements and the laudatory puffs in brokers papers, the "Patent Gas" has need for strong stimulants to prevent its collapse. We have said before that we have examined Dr. Eveleigh's specifications, and have failed to discover anything in them to warrant the exalted opinion of the scheme which would appear to be entertained by speculators in the shares of the Patent Gas Company. Let us recapitulate the chief points in the process. The first is the distillation of coal at a low temperature. It is admitted that there is no novelty in this, but it is asserted that the methods hitherto employed have not been commercially successfully, in consequence of the small quantity of gas produced. We can readily believe it, and must wait to see whether Dr. Eveleigh is more successful. The maximum temperature mentioned in his specification is one at which, according to Dr. Lyon Playfair—perhaps the most able experimenter of the day—only a little gas and much oil is obtained from coal. We have no knowledge of Dr. Eveleigh's scientific acquirements, and no acquaintance with the methods he has adopted for determining temperatures; but we have no hesitation in saying that we shall place implicit confidence in the results of Dr. Playfair, until they are proved incorrect by a competent authority.

Perhaps the part of Dr. Eveleigh's process which wears the air of greatest novelty is the mode of purifying gas from sulphur compounds by passing it through a second retort, heated to dull redness, and packed with chalk, charcoal, and iron filings or turnings. But this can hardly be considered a novelty. It was a plan adopted, if not in the infancy, certainly in the youth, of gas manufacture. For example, there was a patent granted to George Holworthy Palmer in January, 1818, for a then "new mode of "purifying gas." This consisted in passing the gas made by any of the usual processes to a "purifier kept moderately red hot "while in action, to accomplish which it may be set in the same "furnace as the retorts, or heated by a separate fire, so as to be "visibly red by daylight." This purifying vessel is to be nearly filled with the fragments or clippings of sheet iron, clay, argillaceous iron ore, or cinders, in which undoubtedly the same result happened as takes place in the redistillation and purifying retorts of Dr. Eveleigh's first specification.

Nor can the conversion of tar into gas and the mode of effecting it described be regarded as altogether novel. For in a patent granted to John Grafton, in that same year 1818, for an "improved process or method of making carburetted hydrogen gas "for the purpose of illumination," we find, together with a novelty in the setting of the first retort, a claim "also in employing a "secondary retort with feeding apparatus to receive the tar separated from the gas produced by the first retort, and to introduce "the tar into the secondary retort, in order to be redistilled into "gas." This secondary retort is to be heated to redness, and previously filled with iron filings, or coke, or other substances known which will convert the tar and oil into gas. In these two patents, dated 53 years ago, are to be found, we believe, the material points of Dr. Eveleigh's process, and all that can be said to be novel is a cumbrous form of apparatus which few experienced gas engineers would be inclined to adopt.

We have quoted the foregoing specifications because they show the purification and redistillation idea "consummate in its birth," for practically Dr. Eveleigh has added next to nothing to it. A preliminary vaporizing-pan and an intermediate heated chamber may save the redistillation retorts from being choked with pitch, but that is all. The question remains, as we have already said, how much permanent gas is obtained on redistilling the tar. In our opinion, little if anything but condensible vapours are procured. The vapour of benzole held in suspension by a large quantity of gas will, we know, travel a very long distance. Heavier hydrocarbons, which will be volatilized, rapidly condense; and it is still to be ascertained how much gas, and of what quality, Dr. Eveleigh will deliver at the distance of a mile from the works.

Since the patents we have quoted above, numerous inventions have been tried for the conversion of tar into gas, but it is notorious that all have failed. Mr. Basford's process was abandoned notwithstanding the favourable opinion expressed regarding it by some scientific authorities. The original retort-house of the Western Gas-Works at Kensal Green was constructed to carry out Palmer's system somewhat modified, but that also was abandoned. Far be it from us to discourage new inventions and improvements on old processes; but when we see such means taken to give a fictitious value to an invention as are pursued in this case, it is our duty to warn the public against being misled, and to point out that it would be advisable to wait until the system has been fairly tried. We recollect how £60,000 was expended some years since in trying to make the hydrocarbon gas process succeed, and after all it was found that the gases produced by the decomposition of water, and which gave no light, cost more per 1000 feet than good illuminating coal gas.

Gas made from such materials as cabbage-stumps, kitchen grease, and small coal, is, as the patent records bear witness, a very old notion, and we see no reason why such a manufacture should not be common. Probably every farmhouse or country seat produces enough waste material to furnish gas of fair illuminating power, if the apparatus were at hand to utilize it, and people were

not too particular about the smell. The excitement in connexion with the patent just referred to has probably had something to do with the production of a new apparatus for the domestic manufacture of gas. There is nothing in this to alarm gas companies Wherever a supply is at hand, no one will go to the expense and trouble of making his own gas; but in houses remote from towns the plan may be recommended, for the manufacturer and consumer will be the better able to appreciate good gas when he can get it.

The Chartered Gas Company are reported to propose to increase the Beckton works to double their present manufacturing power and storeage room, and to bring another 4-feet main from the works to the metropolis. An increase in consumption, equal to 33 per cent. in three years, is held to justify this immense extension, which will make the Beckton works a wonder of the world.

In connexion with the Beckton works, we may mention the joint appointment by the Metropolitan Board and the Corporation of London of an examiner to test the gas made at that establishment. Each of these authorities have voted as their share of the expenses a larger sum than is now paid to any single examiner; hence the gentleman appointed to this station will be paid more than double the salary of his brother examiners. It may be reasonably expected that the others will lose no time in applying for something like an equalization of payment, and we do not see with what conscience—if it were not absurd to speak of such a thing in connexion with the Metropolitan Board and the Common Council—it can be refused them.

The financial estimate of the Metropolitan Board for the coming year puts the expenses of gas-testing at £735. The Board have now six examiners (including the chief), and next year will probably have ten or eleven; so, judging of great things by small, we have no great opinion of their budget. The expenses of gas-meter testing are estimated at £1799, and the fees are expected to produce £2200.

The Corporation of Ryde and the Ryde Gas Company are now enjoying the luxury of an arbitration under the Lands Clauses Act, to determine what price should be paid by the former to the latter for the purchase of their undertaking, which the Corporation have claimed under an old Improvement Act. We defer a report of the first three days proceedings till our next issue, in order that the whole report may appear in the same volume of the JOURNAL. The claims made by the company and the estimates put forward by the Corporation seem to be more exaggerated than even those in the Dundee case.

The Bolton Gas Company have agreed to sell their undertaking to the Corporation for annuities equal to their maximum statutory profits and a bonus of £2 per share on 11,375 shares, representing a capital of £180,221 10s.

The Hereford Gas Company have also agreed to sell their undertaking to the Corporation at a price to be determined by Mr. Barlow and Mr. Cleminshaw, or their umpire, dispensing with the formalities of an arbitration, and leaving the whole matter in the hands of the arbitrators as valuers. Negotiations are, we believe, pending for the sale and purchase of other large works, the prices asked being either annuities equal to the maximum statutory dividends, or twenty-four years purchase if paid for in money—terms which few shareholders are able to resist.

Paris is, no doubt, enormously taxed, and every economy is desirable; but perhaps the most paltry that could be imagined is that put in practice by the Republican Prefect of the Seine, M. Léon Say, who, away from the leading boulevards and a few principal streets, only lights half the public lamps. The result is that in the evening the city wears a more sombre appearance than —except during the siege—it has worn for a quarter of a century.

In our next number we shall, as usual, reprint the share lists of gas and water companies, and we again earnestly request our readers to render their assistance in making them as correct and complete as possible. To this end we shall be obliged by their returning the slips issued with our present number by the middle of next week, so as to enable us to rectify the errors and fill up the omissions in the list published on the 3rd of January last. Special notice is requested of changes in the paid-up capitals, dividends, or present value of shares. Attention to these particulars, and a prompt return of the slips, is urged, as numerous corrections reach us after the publication of the list, which would have been duly made if they had been sent early enough.

With this number of the JOURNAL our subscribers will receive the last, of the additional plates of the Beckton works.

Correspondence.

INCOME-TAX ASSESSMENT OF GAS-WORKS.

SIR,—In reply to "Secretary," as to "rating of gas-works"—which should be "assessment of profits for income-tax,"—the commissioners are, no doubt, right in their reading of the Act. "Secretary's" company is assessed, the same as other companies, on the *net profits*, and the commissioners say "deterioration-fund" is simply putting away part of your profit. If you repair or alter your plant during the half year, and charge the cost to "works renewal," the commissioners will—as, of course, they ought to do—allow it; but if you put part of the profits to "contingent-fund," "reserve-fund," "deterioration of plant," or any other fund, you are putting by a portion of your profits, *and must pay income-tax thereon.*

Sydenham, Dec. 11, 1871. MAGNUS OHREN.

THE LEEDS GAS EXPLOSION.

SIR,—As to the explosion of gas at the Leeds Gas-Works, I find that there has been some mistake made regarding the sealing of the dip-pipe in the syphon-box. Having had occasion to visit the works the day after the explosion, I measured the box and dip-pipe, and found the box was 20 inches deep, and the sealing of the dip-pipe 16 inches.

Leeds, Dec. 13, 1870. JOHN ARNOTT, *Engineer.*

SIR,—Mr. Tindall's conjecture, published in your last number, as to the cause of the accident at Leeds is inexplicable to me. "Gas," he says, "will take up liquor as well as deposit it, if the temperatures are favourable"—*i. e.*, will take up liquor as its temperature increases, and deposit it as its temperature decreases. Now, I cannot conceive that under any ordinary working the gas would take up liquor between the condensers and the purifiers, as the gas between those points would be gradually getting lower in temperature, and therefore what aqueous vapour remained in it after leaving the condensers would be condensed from it, and run into the syphon-box. For the gas to absorb the liquor from the syphon-box would require that the gas should be raised in temperature after it left the condensers; the temperature may be so raised in the purifiers, but only when the purifying apparatus is defective. TOBIAS CANIS.

Miscellaneous News.

BOLTON TOWN COUNCIL.

The Ordinary Monthly Meeting of the Town Council was held at the Borough Court on Wednesday, Dec. 13—the MAYOR (W. W. Cannon, Esq.) in the chair.

The Purchase of the Gas-Works.

A meeting of the General Purposes Committee was held on the 12th inst. It was resolved—"That this meeting, having considered the proceedings of the Parliamentary Committee in reference to the purchase of the works and undertaking of the Bolton Gas Company, is of opinion that the terms arranged for that purpose, as set forth in such proceedings, should be approved of."

Mr. WINDER moved, and Alderman MARSDEN seconded, the confirmation of the proceedings of the Parliamentary Committee, which included the purchase of the gas-works at the terms of 10 per cent. on the old and 6½ per cent. on the new shares, with a bonus of £2 on each share, or a total bonus of £22,750.

Mr. T. HESKETH moved an amendment to that part of the proceedings which related to the purchase of the gas-works. He did so because he felt that no more could be made out of the gas-works than was to be secured to the shareholders by the corporation. The gas company had power to accumulate their reserve-fund to any sum of less than one-tenth of the capital. That reserve-fund had now reached £15,700, and had it not been for the lavish expenditure on the new gas offices, there was no doubt the gas consumers would ere this have had the advantage of a reduction in the price of gas. The gas offices had cost £15,200, and it was there that the reserve-fund of the company lay, so that, as he said, if the corporation purchased these works they would whitewash the gas company of this extravagant outlay. If the corporation should get hold of the works, they would not be bound by a similar restriction to reduce the price of gas when the dividends amounted to 10 per cent. Not being a private company, trading together for their own advantage, they would be able to charge any price they chose up to 5s. But if there was any money to be made, it was only making it out of themselves—that was, taking it out of one pocket and putting it into another, and the difference would only be that they would pay a gas rate instead of a district rate, with the disadvantage that the heaviest consumers of gas would pay a greater portion of the rates than they would do supposing the gas-works remained in the hands of the company. There was no doubt that at present Bolton was fully supplied with gas, and any profit which the corporation might hope to make would have to be made out of the out-districts. He was advised that every house in Bolton had gas, and that there was no necessity for any extension of the works. The council would thus find that the out-townships would have a perfect right to insist on restrictions being imposed upon the corporation, in order to the protection of their own interests. Hitherto, the borough itself and the out-townships had been united; with reference to the price of gas, they were both interested in obtaining a reduction at as early a period as possible but now the out-townships would have to take care of themselves. The gas company at the present time had a capital of £180,000, and last year—the year 1870—there was an income from the gas-works of £14,034. The corporation contemplated, by the bargain they had made, paying to the share holders a sum of £13,970; so that the only differance between those two sums was £63. In addition to that, the corporation proposed paying to the shareholders a bonus of £2 per share, which amounted to £22,750; the interest on that, at 4½ per cent., came to £1023 15s., so that until they could invest additional capital in the gas-works to a considerable extent, they would certainly as a corporation be the losers. Now then came the question as to the manufacture of gas. He thought he should be right in saying that a number of men like the directors of the company, who were interested in their undertaking, would be much more likely to manufacture gas cheaper than a never-changing body like the corporation. For that reason, it seemed to him that they might put the expense of the manufacture of gas at a higher rate under the corporation than was the case at present under a directorate. Very well, then, supposing they were able to spend £100,000 in the next ten years—and that was a very large sum to put down, because, as he said before, the existing capital was only £180,000, and the company supplied the whole of Bolton and also a very wide area of the out-townships—but supposing the corporation were able to spend £100,000 in the next ten years, the advantage would be this: they expected to be able to make 6 per cent. on that money, and to borrow at 4½ per cent., thereby showing a gain of £2000. But they would, as he said, have to pay £1023 interest on the bonus to commence with; the expense of manufacture would also be larger, and for those reasons it seemed to him that the advantage to the corporation would be infinitesimal. The ex-Mayor, when he was in the position which Mr. W. W. Cannon now occupied—and he (Mr. Hesketh) was sorry he was not present that morning—talked about the expensive nature of the corporate undertakings, and said he for one wished they were fewer. He thought Mr. Walmsley must either have changed his mind, or else the Parlia-

mentary Committee had not been led by him, if they were going into an undertaking of this sort. He (Mr. Hesketh) opposed the scheme because he thought no advantage could arise to the ratepayers, and because the corporation would be undertaking an engagement which he considered would be by no means productive. He therefore moved that the proceedings of the committee be confirmed with the exception of those portions relating to the purchase of the works and undertaking of the Bolton Gas Company.

Mr. E. CANNON seconded the amendment. He called attention to the fact that the gas company were themselves willing sellers, and therefore they were asking too much. Had they been content to take the price of the works as they stood on the books, without a bonus, he believed the corporation would have done a good thing in buying them.

Mr. P. C. MARSDEN supported the amendment. He came there pledged that he would not recommend to the council any large scheme until they had completed their present works, and it seemed to him that the purchase of the gas-works was a very large undertaking.

Mr. KEVAN said it had been his intention to remain neutral, because he had a little interest in the Bolton Gas Company, but he took it that by the action of the directors of that company, in whom he, as a shareholder, had the utmost confidence, in agreeing upon the price they were willing to accept for their undertaking, and which they were unanimously prepared to recommend to the shareholders, he was relieved from that position, and was enabled to act as a member of the council. He would therefore inquire what benefit would be likely to arise from the transfer of the undertaking. He had not had very much experience in corporation business, and therefore he was not able to say what would be the effect of the centralization of the authority. Many members of the corporation would be able to form an opinion, and from their experience would be able to say whether the centralization of authority with reference to the streets and various other matters would be an advantage to the corporation. He wished to say a few words with reference to the question of the probable profit that would be realized. The gas company were established more than 50 years ago, in 1818. Between that period and 1854 they expended a capital of £64,498, for which they were allowed to pay a dividend of 10 per cent. In 1854 they obtained powers to increase their capital by the sum of £123,189, on which 6½ per cent. was to be paid. In 1861 the outlay (according to the accounts) upon the works amounted to £89,522. In the ten years from 1861 to 1871, the expenditure had more than doubled the value of the works, and the expenditure on capital account had more than doubled, a sum of £96,000 having been expended in those ten years—an average of £9600 a year. To show that that expenditure had been productive, it was necessary to refer to the net gas-rental for the period. In 1861 the net gas-rental was £23,714.

Mr. T. HESKETH: Is that profit?

Mr. KEVAN: No, it is not profit. The average charge for gas in the borough for the year ending June, 1861, was 3s. 9d. per 1000 cubic feet. In the year ending June, 1871, the gas-rental was £45,129, very nearly double, notwithstanding the reduction from 3s. 9d. per 1000 to 3s. 4d. This showed a satisfactory increase of rental for the outlay, and proved that the outlay was to some extent, if not entirely, a judicious outlay. The average increase of rental during the ten years would be about £2500. If the works had been purchased 15 years ago, when the present 6½ per cent. capital began mainly to be expended, the saving to the borough up to the present time as between 4½ per cent., which the corporation would have paid, and 6½ per cent., which the shareholders were entitled to, would be about £11,000, and the saving now would be about £2000 per annum. That was a question of the past: then came the future. The gas company had, he believed, expended the whole of their capital. They were proposing to go to Parliament for increased powers, and possibly they would acquire powers to obtain another £100,000 or £200,000 of new capital, and probably at 6½ per cent. If they took the average expenditure for the last five years on capital account, it had amounted to nearly £14,000 a year; and assuming the average expenditure for the next five years was £15,000, that would be a total of £75,000. In three years out of those five years, with 2 per cent., they would save £1500 a year, and the amount would go on constantly and regularly increasing with every additional outlay on capital. There were other questions beside the question of profit in connexion with the gas-works. There was the question of management. It perhaps showed becoming modesty on the part of members of the council who were opposed to this scheme to say the council would not be able to manage it as well as the directors. It would be for the gas consumers and the ratepayers to find that out, and if they found out that the present men could not do it, they would surely send other men. Not that he found any fault with the present management, for they had every confidence he could place in them; but it was not to be assumed they would always have the same gentlemen managing the gas company's works as at present, and therefore there was a probability of change for the worse in reference to that. The directors were honorary directors almost, but they might find that with increasing capital, responsibilities, and duties, the directors would be paid very handsomely. They ought to be thankful to the gas directors at present for not taking large sums, but they might do so. There were illustrations in neighbouring towns of the transfer of gas-works, as at Leeds, Bradford, and Rochdale, and he believed it would be borne out by fact that the average charge per 1000 feet of gas was as low, if not lower, when the gas was made by the corporation than it was when made by companies.

Several other speakers followed, only one of whom (Mr. W. Hesketh) announced his intention of supporting the amendment. It was the opinion, however, of some that the bonus was too large, and of others that there should be no bonus at all; whilst one or two held that the terms were as reasonable as had been obtained by other corporations. Ultimately, the amendment was withdrawn, and the motion was declared to be carried unanimously, several members, however, abstaining from voting.

BOMBAY GAS COMPANY, LIMITED.

The Half-Yearly Meeting of this Company was held at the City Terminus Hotel, Cannon Street, London, on Thursday, Dec. 14—DANIEL THOMAS EVANS, Esq., in the chair.

The SECRETARY (Mr. Marshall) having read the advertisement, the following report and statement of accounts were presented.

The directors have pleasure in submitting to the shareholders the accounts, duly audited, for the half year ended the 30th of June last.

In contrasting the working of the company during this interval with that of the corresponding half of last year, it should be borne in mind that the latter comprised the profits on sale of gas and fittings arising from the illuminations in honour of the Duke of Edinburgh's visit to Bombay. This circumstance considered, it will be seen that the progress of the company has been satisfactory.

There has been a steady, though not rapid, increase in the sale of gas; and the cost of production has decreased.

The contract with the municipality came into effect on the 1st of August.

The accounts show a net profit for the half year of £9466 24s. 2d.; and, after appropriating £1500 to the reserve-fund, your directors declare an interim dividend, free of income-tax, at the rate of 6½ per cent. per annum, leaving a balance of £1698 11s. 7d. to be carried forward to the credit of the current half year.

Dr. — *General Balance-Sheet, June 30, 1871.* — *Cr.*

To Capital authorized, viz.:— (50,000 shares, at £5 each—£250,000.)					By construction account				197,905	5	3
40,000 shares, £5 paid			200,000	0	0	Amount owing to the company			17,018	9	10
10,000 „ £4 paid			40,000	0	0	Goods *in transitu*			5,584	16	4
			240,000	0	0	Stock in trade, viz.:—					
Amount owing by the company					9,207	15	7	Chandeliers, brackets, &c.			8,994	17	5
Debentures					5,000	0	0	Brass and iron goods, tubing, &c.			11,003	16	11
Dividend					8,400	0	0	New works, materials, mains and services			2,672	1	11
Reserve-fund			2,782	0	4	Meters			6,340	19	2
Premium on debentures	110	19	9			Coal			12,196	6	2
Added this half year	1,500	0	0	1,610	19	9	Coke		151	2	8
			4,393	0	1	Tar			1,304	11	7
Written off chandeliers, meters, tools, &c.			942	4	4	Oxide, tools, fire materials, &c.			1,865	11	4
					3,450	15	9	Retort account			567	7	4
Insurance-fund					322	14	4	Cash at bankers and in hand	5,425	15	10			
Passage-fund					151	4	6	Bills receivable	5,000	0	0			
Balance to general revenue account					9,498	11	7					10,425	15	10
				£	276,031	1	9			£	274,031	1	9

Dr. — *Profit and Loss Account, for the Half Year ending June 30, 1871.* — *Cr.*

To Coal carbonized				7,178	1	5	By Gas and meter rental			19,725	10	0
Wages				1,315	16	8	Coke			2,650	2	7
Purifying				30	13	9	Tar			163	12	1
Maintenance of retorts				113	0	0	Fittings			351	19	8
Trade and general charges				1,043	15	0	Transfer fees, &c.			20	4	3
Salaries and collectors commission				1,752	12	11						
Rents, rates, and taxes				613	15	6						
Law expenses				37	8	11						
Directors and auditors remuneration				851	5	0						
Bad debts and allowances				107	7	10						
Exchange and interest				400	17	5						
Net profit				9,466	14	2						
			£	22,911	8	7			£	22,911	8	7

Dr. — *General Revenue Account, June 30, 1871.* — *Cr.*

To Dividend for the half year ending Dec. 31, 1870				8,400	0	0	By balance, Dec. 31, 1870			9,931	17	5
Amount carried to reserve-fund				1,500	0	0	Net profit for the half year ending June 30, 1871			9,466	14	2
Balance carried down				9,498	11	7						
			£	19,398	11	7			£	19,398	11	7
							July 1, 1871.—Balance brought down		£	9,498	11	7

The CHAIRMAN, in moving the adoption of the report, said he thought the working of the company during the half year would be considered a fit subject for congratulation when contrasted with that of the corresponding half of 1870; for then they had the adventitious profit arising from the visit of the Duke of Edinburgh to Bombay, and the illuminations on that occasion, which yielded in round numbers £2000 as profit on the sale of gas and fittings. Remembering that circumstance, it would be seen that the progress during the period now under review had been substantial and good. It was not his custom, as chairman, to go minutely through the accounts at these interim meetings as he was in the habit of doing at the annual meetings, because he felt that a statement of six months working was scarcely a sufficient basis on which to estimate the progress of the company. There were, however, two or three points to which he would call attention. It would be seen from the report that the net profit of the half year was £9466 14s. 2d., and that after appropriating £1500 to the reserve fund, and declaring an interim dividend at the rate of 6½ per cent., there remained a balance of £1698 11s. 7d. to be carried to the credit of the current half-year. In looking at the general balance-sheet it would be seen that the "construction account" had been increased by upwards of £7000 during the past six months. The principal item in this expenditure was the cost of building a house for the manager, and the purchase of land therefor, amounting to £3000. But when he informed the proprietors that the outlay of this money would put an end to a payment of £300 a year, which had hitherto been paid in rent of the manager's house, it would, no doubt, be regarded as a wise economy on the part of the directors to buy the land and erect the house as they had done. The next item in the expenditure, under this head, was for stores and workshop, £1700; and the third was for extensions of mains, £2900, to enable the company to carry out their new contract with the Municipality of Bombay. During the half-year the stock of fittings had been decreased upwards of £2000 by sales and new services laid on. The carbonising account had been favourable. The cost of coals into the retorts during the half-year was £2 2s. 9d. per ton, as against £2 4s. 1d. in the corresponding half of 1870. The make of gas, per ton of coals, was 9800 cubic feet. On the last occasion he prepared the proprietors to expect that there would be an increase in the leakage, arising out of the operation of laying new mains. It had, in fact, been as high as 14¾ per cent., but that was now at an end; and from a careful examination of the four months subsequent to June, he had satisfied himself that it was now reduced to 10 per cent. There was an apparent decrease in the rental of £259, but that was due to the circumstance that the past half year was contrasted with that which embraced the period of the visit of the Duke of Edinburgh. This

decrease was more than compensated by the increased profit of £554 on the sale of coke. The profit and loss account was almost entirely favourable. With reference to coal—the raw material from which the revenue of the company was derived—he might state that the directors had taken advantage during the last six months of freights being very low to lay in a large stock of coal at Bombay, enough, indeed, to ensure the dividend for the next two years, even supposing there were no increase in the consumption of gas. They were now putting coal into the retorts at a lower price than they had ever been able to do before. At the present time they had in Bombay two years supply, as well as a quantity afloat; and he might inform the meeting that it was well the directors had made this provision, because the price of gas coal shipped in the Tyne had risen from 6s. 6d. to 8s. 6d. per ton, and even at the advanced price coal was not to be had in any quantity at the present moment. The proprietors would, therefore, he was sure, concur in thinking that the directors had acted wisely in procuring a stock sufficient for the next two years. The works were reported to be in good condition. It would be remembered that the bulk of the service-pipes had been laid for seven years, and from the peculiar character of the soil of Bombay it was found that they decayed very rapidly; the directors, were, therefore, renewing them as fast as possible. No doubt much of the leakage was due to the decay of the service-pipes, and the steps now being taken would have the effect of reducing it month by month. The next thing to be mentioned was, that at the present time the Municipality of Bombay were under a cloud. They had been for some years spending more than their income, and the directors of this company were suffering some embarrassment in consequence. Two bills of the Municipality, (which were given for accounts rendered, admitted and approved) for £5000 each, had been dishonoured. This fact, however, need not alarm the proprietors, because the income of the Municipality of Bombay was upwards of £350,000 a-year, and, although they were embarrassed with a very heavy debt at present, they were now paying the accounts of the company monthly, and the directors were well assured that the dishonoured bills for £10,000 would be paid in a very short time. He held in his hand a telegram on this point, which had just been received from their able accountant in Bombay. It ran thus:—"Justices met this day. Commissioner authorised to raise an immediate loan to liquidate Municipality outstandings." He thought they might rest assured, under those circumstances, for an early settlement, and that the Chartered Mercantile Bank, which now held the bills over (having taken from the company an assignment of the debt), would be paid in the course of the month. This cause of embarrassment—which was quite unexpected—and some other matters, had rendered it necessary, in the opinion of the directors, to increase the working capital of the company. They had, as already stated, laid in a large stock of coals. At the end of the current year £26,000 would be so invested. They had in the course of twelve months paid £10,000 and more on construction account; and they found it therefore necessary, in the interest of the company, to increase the working capital by a sum of £15,000. This they proposed to raise upon debentures, as in the first instance they raised £5000. That was done at a profit, as he had no doubt this would be. It was proposed to issue them at three, five, and seven years—bearing 6 per cent. interest as before—to be divided rateably among the shareholders, according to their biddings. By raising this £15,000 the directors would be put in funds to carry on the business of the company in a more satisfactory way than at present. It so happened that they sometimes on an emergency had to pay considerable sums of money in England, when there were large sums held by them on the other side, and they were compelled to call for that money even when the exchange was heavy against them. This step would enable them to overcome that difficulty and to retain money on deposit account in Bombay until they could work the exchanges satisfactorily. Having made these remarks, he formally moved the adoption of the report and accounts.

Mr. COLLIER seconded the resolution.

Mr. THORPE said he should move as an amendment that the dividend be at the rate of 6¾ per cent.

The CHAIRMAN said it was not competent to the hon. proprietor to do so, this being an interim dividend declared by the directors under the provisions of the articles of association.

Mr. THORPE objected to the chairman's ruling, and said he would shortly prove to the meeting that the concerns of the company were not in so favourable a state as the report presented or the chairman's address would lead them to believe. In doing so he should contrast the affairs of this company with those of its sister undertaking, the Oriental Gas Company—a company which had been paying 10 per cent. dividends. Looking to the profit and loss account it would be seen that, with a stock of fittings on hand, amounting to nearly £9000, they had only sold £350 worth during the half-year.

The CHAIRMAN said the £350 was not the total amount of the sales, but the profit made on the sales.

Mr. THORPE said the next point upon which he wished for an explanation referred to something which was not, but ought to be, in the profit and loss account. On a former occasion the chairman told them that the Municipality were backward in their payment, and that they were in consequence charged 1 per cent. per month upon the arrears. He had heard on the best authority that, when that item came before the Municipality, on the occasion of renewing the contract, it had to be given up. But it had been taken credit for, and dividends paid out of it, and, therefore, he asked what had become of the £1500 which was not to be found in the accounts now. He next wished to utter a protest against the item of £851 for directors and auditors fees. The remuneration of the directors had been increased to £1000 per annum, but, according to the present accounts, they had received £300 more during the half-year than they were entitled to take. But for that, the dividend on this occasion might be increased a quarter per cent. He therefore moved that that increase be made.

The CHAIRMAN said he had already stated that it was not competent to the shareholders at these meetings to disturb the dividend declared by the directors. The board were only bound to render accounts once a year, but in deference to an expressed wish, which they cheerfully met, they presented them every six months.

Mr. THORPE said in that case his amendment would be, that the allowance to the directors be reduced £300 on this occasion.

Mr. STEPHENSON, in replying to the last speaker, said he would show how utterly inconsistent he was in the course he adopted. At the last interim meeting Mr. Thorpe made a charge against the directors of trafficking in the shares of the company, and asserted that they increased the dividends for the purpose of raising the price of the shares in the market: He (Mr. Stephenson) called upon Mr. Thorpe at the time to prove what he stated, but not the slightest attempt had he made to do so, and the reason was that there was not a shadow of truth in it. Mr. Thorpe on that occasion went further, and said that the board declared an increased dividend upon "the fluke" of the additional profits arising out of the Duke of Edinburgh's visit to Bombay; and with admirable consistency he now came forward and asked the directors to declare a higher dividend than they did this time last year. He might mention that Mr. Thorpe had been a candidate for the office of auditor of the company; but he did not meet with the support of the proprietors, and the manner in which he now raised objections showed how his failure had operated upon him. In reference to the Oriental Company, with which Mr. Thorpe contrasted this company, it must be borne in mind that it had been established a greater number of years, and in its early history paid only small dividends; and although of late it had been paying 10 per cent., it had now returned, with very good and satisfactory reasons, to 9 per cent. He (Mr. Stephenson) maintained that it was not desirable to pay high dividends until the certainty of maintaining those dividends was fairly assured. It was upon this principle the directors of the Bombay Company had proceeded. They no doubt, upon the accounts just presented, could pay a higher rate; but as a matter of prudence and advantage to the company they did not think it desirable, for surely nothing was so disastrous to a gas company, or any other company, than, having paid a high dividend, to go back to a low one. There was a very sufficient reason why in this undertaking a high dividend should not as yet be declared. The price of gas to private consumers in Bombay had until lately been seven rupees per 1000 cubic feet—a price which he contended was prohibitive; and the directors meant to adopt the policy of reducing the price as rapidly and judiciously as possible, believing that they would thus increase the number of private consumers, and utilize their works, which at present were employed to only about half their capacity. Another matter to which he might refer was this: The Oriental Company were using native coal, which they obtained into their works at very low rates—something like 21s. per ton—whereas the coal used by this company cost a little over £2 per ton. With reference to the stock of fittings the shareholders knew very well, for it had been explained to them over and over again before he (Mr. Stephenson) became a director. Mr. Hawksley, under whose advice those fittings were sent out, had himself proved that the company were justified in believing there would be a large demand for them, and no doubt, but for the extreme depression which subsequently occurred in Bombay, the expectations in this respect would have been realised. As it was, they must do the best they could with these fittings. During the past three years something like £3000 in round numbers had been written off the account for them; a considerable portion had been sold, and they must wait their time to realise the remainder. Mr. Thorpe spoke of there being differences of opinion between the directors and the Municipality. It was not true that such was the case. There were differences originally, but since the new contract for the public lighting had been arranged, no such differences existed. The only question now was as to the payment of the bills given to the company, and there was not the slightest doubt that these would be ultimately settled. Now Mr. Thorpe spoke of £1500 being allowed to the Municipality, and he insinuated that the directors, having first of all put it in the account, had afterwards appropriated it amongst themselves. The truth was that this sum of £1500 was a charge on capital account as pertaining to the pipe laying; the directors had always treated it, and it was allowed to the Municipality on settlement with them, as the charge for repairing the streets and roads, after the operations of the company. So far as the other complaint of Mr. Thorpe went—viz., the increased remuneration of the directors, that was a matter determined upon at the annual meeting, and confirmed at a special meeting called for the purpose, and nothing further need be said upon it. If the directors had erred at all, it was owing to the kindness of the shareholders themselves. Before sitting down he wished to say a word or two in reference to the position of the company, and the reason why the directors contemplated the raising of £15,000 on loan. In the first place, there was the very large debt of the municipality which they had to provide for, though they felt confident about ultimately receiving the whole of it. In the next place, it was known that the directors had hitherto been obliged to have money sent over from Bombay, when the rate of exchange was low, because it was required on this side; whereas, if they had had more working capital, they would have allowed the money to remain there, until the exchanges were favourable, which generally happened about the months of March and April. When they were in possession of the money proposed to be raised, they hoped there would not be a recurrence of the item "exchange and interest £400 17s. 5d.," as in the present accounts. With reference to the purchase of coal he believed, and his colleagues concurred with him, that it was most desirable to keep a large stock of coal in Bombay. If they had only a small stock, and were compelled to rush in a state of panic into the market for supplies, they were sure to have to pay very heavily for freights; and, on the other hand, if they kept a good stock on hand, they were independent of the shippers, and could often arrange for very low freights. In 1868 when they were under pressure, they had to pay as high as £3 6s. 2d. per ton for coal, whereas, all the coal lately laid in, had been obtained at nearly £1 per ton less, and this reduction on a large stock made a considerable difference in the results of the working operations. As to the progress of the company, he might point out what was the rental during the past four years, to show the increase of the business and the necessity for additional working capital. In 1867 the gas rental was £29,440, in 1868 it was £35,410, showing an increase of nearly £6000, in 1869 it was £38,709, showing an increase on the previous year of £3300. In 1870 it was £41,143, showing an increase on 1869 of £2443. So that from 1867 to 1870 the gas-rental increased from £29,400 to £41,143—a most satisfactory progressive increase. It was not to be anticipated that the increase would go on at this rate, for this reason, that the directors had practically reduced the price of gas to the municipality, by giving them an increased number of lights for the same money; which would affect the rental to a certain extent. And this was one reason why they were anxious not to give a higher dividend at the present time, they wished to see what the effect of the new contract would be. Then, again, they were beginning to reduce the price of gas to consumers generally, which would have an effect upon profits at first, though ultimately it would turn to the advantage of the company.

Mr. STOKES said he thought the directors had acted wisely in making large contracts for coal, but they should remember that there was a limit within which they should keep themselves. The amount they now had in stock—£26,000 worth—represented a two years consumption, which was a very great sum to have invested in this way. He had before suggested the propriety of the directors insuring their coal, and he hoped the subject was one which had received their attention. He had no doubt the business of the company would increase considerably, as the directors were taking the wise course of reducing the price of gas to private consumers.

Major STUART expressed his confidence that the municipality would honourably meet their engagements with the company; and with regard to the stock of coals, he remarked that it had been increased through the necessity of allowing a very wide margin in the purchase of cargoes from Australia. Fortunately for the company, this stock had been laid in very advantageously—some at as low a price as 36s per ton—into the works. As the price of coal in Australia, as well as in England, was advancing, it was an advantage to have a good stock in hand. With respect to the question of insurance, it should be known that Australian coal was not liable to combustion, and that the company took every precaution with their English stock to prevent such a contingency.

Mr. SEWELL asked whether the coal stores of the company were covered over.

The CHAIRMAN said 5000 tons of coal were under cover, and the directors were providing protection for the remainder of the stock as rapidly as possible.

Major STUART said the Australian coal was obtained in large blocks, and suffered very little deterioration from exposure to the weather.

The CHAIRMAN, in answer to further inquiries, said the new service-pipes were being laid in V-shaped troughs, and surrounded with tar and asphalte to protect them.

Mr. PROUD (late manager in Bombay) said he was glad to hear that the bulk

f the coal in stock was Australian. If it had been English there might have been a serious loss, especially if it had been stored in a damp state. As it was he did not anticipate there would be any great deterioration for gas-making purposes. He might inform the proprietors that the coal stores in Bombay were thoroughly well ventilated, and the coal could be got at in every direction, therefore there was not the least chance of combustion, and no necessity whatever for insuring the stock. As to the debt of the Municipality of Bombay, if it were due to him personally he would not sell it for 19s. 11d. in the £, so great was his confidence that it would be honourably discharged.

Mr. SEWELL asked whether any coal had been sent from England lately, and also whether the company's buildings were insured?

The CHAIRMAN said no coal had been sent from England since May last. The buildings were not insured; and as they were composed of iron and stone there was no need for such a precaution. The stock of fittings was insured.

Mr. THORPE having withdrawn his amendment,

The motion for the adoption of the report and accounts was put, and carried unanimously.

A vote of thanks was given to the chairman and directors for their services during the past half-year.

The CHAIRMAN, in acknowledging the vote, said the directors had from the first conscientiously done everything to the best of their judgment for the interests of the company, they challenged the most searching scrutiny of the accounts, and they felt very much gratified at this renewed expression of the confidence of the proprietors.

BRIGHTON TOWN COUNCIL.

A Meeting of the Brighton Town Council was held on Wednesday, the 6th inst.—the EX-MAYOR (Mr. Alderman Webb) in the chair.

The following report of the Works Committee on the water supply was presented:—

To the Members of the Works Committee.

Gentlemen,—We, the undersigned, who with the town-clerk were requested by you to meet the directors of the water company, beg to report as follows:—

We had ascertained that the £10 shares of the company (fully paid up) sell for £14, and this is unquestionably the present value of the shares in the open market.

The annual dividend amounts to 7 per cent. (free of income-tax), and the appreciation by the public of the security that that dividend will be maintained can be measured from their giving a price which simply produces 5 per cent. on the outlay.

We took this market value as the necessary basis of negotiation, and proposed to add to that the 10 per cent. which the corporation have had to make under the Lands Clauses Act when they acquired property by compulsory powers.

This proposal was recognized by the directors as one conceived in the spirit of an amicable settlement, but they on their part pointed out that larger terms had been given to water companies where (notwithstanding the resistance of a company) Parliament had decided to transfer the water control to the corporate body. This was stated to amount to 24 years purchase of the current income. Seven multiplied by 24 would give 168 as against (140 *plus* 10 per cent. or) 154 for £100 stock involved in our proposal.

We then suggested that the difference between our views should be referred to arbitrators, who should decide whether the undertaking in question was such a one as would be awarded as 24 years purchase, if taken under parliamentary powers, or whether any and what addition ought to be made to our proposal. At our second interview with the directors, they expressed themselves very favourably impressed with our offer of arbitration upon the difference between our estimates, and showed us from the experience of former arbitrations that such a process has been an exceedingly wasteful course to the parties interested, the expenses having in some cases amounted to a considerable per centage on the entire purchase.

On our part, we had to consider that a parliamentary settlement of the price would have to include some compensation to existing officials, as happened to the council, in case of the clerk of the peace, when the borough sessions were established, and we agreed, after a protracted but very friendly discussion, to take the £10 paid upon shares at £16.

Out of the total capital raised by shares, about £2900 is at present unexpended, which will, under the arrangement, be capital held for the corporation for additional works, which the directors were preparing to carry out.

We believe that the price arrived at is equitable to both parties. To the shareholders it secures them at once 20 years purchase of the maximum dividend their Act permits—namely, 8 per cent. And this it seems to us ought to be satisfactory to them, as they will have a parliamentary guarantee for it, and it is as high a price as they may reasonably expect to obtain upon an 8 per cent. dividend, seeing that for a long time before this negotiation was on foot the market price of shares has been such as to produce 5 per cent., or 20 years purchase.

We have now to submit how it is equitable to the corporation as purchasers, and the means by which we propose to raise the money, and pay off the capital sum.

For water undertakings, Parliament has frequently granted Acts to corporations to extend the time for repayment over 70 years. The second report of the Royal Sanitary Commission, issued last year, in offering suggestions for the enactment of a Consolidated Local Government Act, recommends that, in the case of the purchase of water undertakings, local bodies should have an extended term of 75 years for repayment, and we feel perfectly warranted in submitting a scheme for repayment extending over 70 years as one which, under the advice of the parliamentary agents and Mr. Hawksley, may be relied on as being granted in this case.

Estimating the rate of interest to be paid at 4½ per cent., the equal annual payment required to extinguish the capital sum in 70 years is £4 14s. 4d. per cent.

Thus, on £100,000, the annual payment for 70 years would be £4717, which would be apportioned as follows for interest and repayment of the capital sum:—

1st year—Interest.	£4500	....	Capital	£217
2nd " "	4491	....	"	226
3rd " "	4481	....	"	236
4th " "	4470	....	"	247
5th " "	4459	....	"	258
6th " "	4447	....	"	270
7th " "	4435	....	"	282
8th " "	4422	....	"	295
9th " "	4409	....	"	308
10th " "	4395	....	"	322

The sum applicable to the sinking-fund increasing every year during the term, whilst the demands for interest diminish.

The share capital paid up is £199,000—at 160	£318,400	0	0
Add for land bought for the protection of the works, not paid for from share capital	2,756	11	8
	£321,156	11	8

There is also a mortgage debt of £27,000 at 4½ per cent., for a term, the interest on which is included in the expenses stated below.

The annual payment on the £321,156 11s. 8d. would be	15,168	0	0
The means of meeting this are as follows:—			
Net rental 1870, after allowing for empty houses	21,598	0	0
Less average expenses	8,000	0	0
	£13,598	0	0

[These include coals, ironmonger, plumber, engineer's, and building repairs, wages and office staff, salaries of directors and secretary, interest on mortgage, income-tax, and sundries.]

Average increase of rental:—

1st half year, 1871	£250	0	0
2nd " "	250	0	0
1st " 1872	250	0	0
Less cost of pumping, &c., at 20 per cent.	150	0	0
	600	0	0
Included in above expenses, salaries of directors and secretary	900	0	0
Less, allow for water engineer	300	0	0
	600	0	0
Income-tax paid by company in above expenses	220	0	0
	£15,018	0	0

The regular increase of the water-rental amounts, on an average, to, at the least, £500 per annum, and this increase, in the second half year of 1872, when the corporation would commence operations, will equalize the payments set out.

As regards the mode of raising the money, although there is no doubt this can be obtained of large insurance offices at the rate named, it is thought desirable to include in the bill a power to raise money on debentures of £100 each, to bear interest at 4½ per cent., and that the shareholders of the company should have the option of being paid in this manner.

The debentures to be paid off in the order of their issue, as the sinking-fund, from time to time, will afford the means.

The corporation can, if they choose, reserve power in their debentures to pay them off and borrow on lower terms if the state of the money market should hereafter encourage them to do so.

There will thus be provided a means for local investments of spare capital, which has not existed since the old commissioners loans were closed, and it is believed this will be appreciated by Brighton investors.

We subjoin minutes of the terms arranged at the last interview, which are to be embodied in an agreement, if approved by the council and shareholders of the water company.

Minutes of Conditional Agreement.

That the price to be given for the undertaking, which is subject to the mortgage for £27,000, should be £16 per share of £10 paid (total share capital £199,000) and £2756 11s. 1d., the debt due to the contingent-fund for land bought for the protection of the water-works.

The contingent-fund belongs to vendors.

The balance of unexpended capital to belong to purchasers.

In case of the Town Council and the shareholders of the water company confirming this agreement and an Act being obtained, the transfer to take place from June 30, 1872.

(Signed) WM. HY. HALLETT.
HENRY ABBEY.
DANIEL FRIEND.

The Works Committee recommend the council to confirm this arrangement, and that an agreement to carry this out be entered into by the council and directors of the water company. They further recommend that in this agreement the water company should undertake, if necessary, to oppose any applications to Parliament this session for new water-works, which may affect the scope of this undertaking. The expenses so incurred to be borne by the corporation.

The committee annex to this report copies of the following documents:—

1. A letter from Mr. Evershed, the secretary to the water company, with a copy of a report made to the company on the 20th of November last by their engineers, Messrs. Eastons and Anderson.
2. A report made to this committee by Mr. T. Hawksley, C.E., of the results of an inspection of the company's works, made by him on behalf of the corporation.

In conclusion, the committee recommend that the further conduct of the Brighton Corporation Water Bill be transferred to the General Purposes Committee.

On behalf of the committee,
(Signed) DANIEL FRIEND, Chairman.

Town-Hall, Brighton, Dec. 1, 1871.

Princes Street, Brighton, Nov. 27, 1871.

Brighton Water.

Dear Sir,—In order for the information of the deputation of the Works Committee, I beg to state that in a report made to the water company, on the 20th inst., by their engineers, Messrs. Eastons and Anderson, those gentlemen say as copied below.

Yours truly,
(Signed) EWEN EVERSHED.

David Black, Esq., Town-Clerk.

With regard to the present condition of the company's works, with the exception of the less powerful engine at the Lewes Road station, the whole of the plant is in thorough working order, and the pumps are doing their full amount of duty as ascertained by actual measurement. The deep well pumps of the 100-horse power engine referred to are now being overhauled, as it was found they were not lifting much more than half the proper quantity, and in a short time these will be in an equally effective condition.

It may be taken as a fact, from calculations made of the quantity used during the race week of this year, that 18 millions of gallons is the maximum of supply to the town in any one week.

The water is supplied to the town through pipes arranged in four zones or districts at different levels, the upper one of which is at present little occupied with houses, and may be left out of the calculation, as the quantity used daily is very small, and the reservoir holds quite a fortnight's supply for the existing consumers.

The next zone or district, called the high service, comprises about two-ninths of the whole number of services supplied by the company. It is fed from two reservoirs, one at Park Road, on the east, containing 500,000 gallons, and one at Dyke Road, on the west, also containing 500,000 gallons.

The next district in order is the middle service, supplying about three-ninths of the population, and fed from a reservoir, or rather two reservoirs joined together, near Brighton Park, containing two millions of gallons.

The remaining and lowest zone supplies four-ninths of the whole, and is fed from two reservoirs, one above the Lewes Road station, containing 1,000,000 gallons, and one at Goldstone Bottom station, of 500,000 gallons.

Therefore, taking the maximum daily supply at 2,600,000 gallons, being one-seventh of the 18 millions, we find that the low service requires 1½ millions of gallons, and has reservoir storeage equal to ½ days. The middle service requires 850,000 gallons, and has a storeage for 2½ days, and the high requires 500,000 gallons and has a storeage for 2 days.

The pumping plant belonging to the company consists of two separate stations—viz.,

One at the Lewes Road, where there are two engines of the nominal power of 100 horses and 150 horses respectively.

One at Goldstone Bottom, where there is an engine of 150-horse power.

The water is obtained from several wells, and very extensive tunnels made in the chalk. These have been made, and extended from time to time since the year 1854, as the wants of the company's customers demanded an increased supply. The quantity of water obtainable from each station is more than sufficient to supply the maximum quantity now required by the town.

The pumping power of the engines, at the regular speed of 14 strokes per minute, is as follows:—

	Horse Power.		Gallons per Min.
Lewes Road station	150	..	150,000
Do. do.	100	..	130,000
Goldstone Bottom do.	150	..	150,000

It is not the practice to pump on Sundays, and therefore the 18 millions of gallons are raised during six days of the week, or at the rate of 3 millions of gallons daily. This is accomplished generally by working the engine at Goldstone 9 or 10 hours, and one of those at the Lewes Road station about the same time, at the ordinary speed, but, if required, the whole supply of the town can be managed from one station only, by working the engine at Goldstone Bottom 20 hours instead of 10, and at Lewes Road station, the two engines together, for 10 or 12 hours.

In case of emergency, the strokes can with safety be increased to 16 per minute at least, when the number of hours would be reduced to 18 for each of the larger engines, and to 22 for the smaller. Pumping might also be done on the Sunday, thus further lessening the time of daily working.

It will be seen from these facts that the company possesses three engines, each capable of pumping within the 24 hours with ease the maximum quantity required by the town. For this reason, as well as for the consideration that the reservoirs hold two days supply, it has not been considered necessary to put the company to the expense of duplicate parts for the pumps and engines. The boiler power at each of the works is amply sufficient, amounting to more than 350-horse power at the Lewis Road station and 240-horse power at Goldstone.

The above figures relate to the supply of the town, in the aggregate. Considering the capabilities of the company's plant to keep up the three services, the following is the result:—

The high and low services as already mentioned have reservoirs on both sides of the town, with main-pipes connecting them. Those on the west side were constructed in 1863 and 1865, when the western districts increased, and it was found difficult, in consequence of the great length of the supply mains, to give proper pressure to those districts. They are on the same level, the effect of which is that during the night, when little water is drawn by the consumers, the water pumped into the reservoir at the one side passes through to the reservoir on the other, and becomes available in the morning for the wants of the district, the supply being drawn at an equal pressure from both reservoirs simultaneously. A similar arrangement, as recommended in our Mr. Edward Easton's report, dated Oct. 7, 1870, is in process of carrying out for the middle service also, the land having been bought, and the new pumps and pumping main fixed at the western side.

Each engine at the Lewes Road station has, besides the deep well pumps, which lift into the low service, subsidiary pumps for raising part of the water to the high and middle service, and these are of such a size that, with a little management, they keep up the three services in the proportion named in the first part of this report of 4-9ths to the lower, 3-9ths to the middle, and 2-9ths to the high, so that, whilst the engines are working, each zone is replenished as the demand upon it requires.

At Goldstone Bottom, however, until the recommendations of the report of October, 1870, before referred to, are fully carried out, the same result cannot be attained, but it is found necessary to let down water from the high into the middle, and sometimes even to let some water from the low service run into the sea, because of the difficulty of getting the water to pass freely through the mains from one side of the town to the other. Nevertheless, as before stated, the whole of the town can be supplied from Goldstone Bottom station if necessary.

The conclusions we draw from these facts are, that as far as regards the present wants of the town no further works need be taken in hand, and were the town at a standstill in point of population, the existing plant of the company would be ample for the following general reasons:—

1.—That the company possesses sources or supplies of water, each sufficient at the driest season to give the maximum daily quantity required.
2.—That they have three seperate sets of pumping apparatus, each more than capable in the 24 hours to pump such maximum quantity.
3.—That they have reservoirs besides, equal to two days supply.

"*To the Works Committee of the Town Council of the Borough of Brighton.*

"*Dec.* 1, 1871.

"Gentlemen,—In compliance with your instruction, I have made an inspection of the works of the Brighton, Hove, and Preston Constant Service Water Company, and have to report that the principal and visible works of the company are in excellent condition, and that they are also fully competent to the supply of the existing population, and to the earning of the income upon which the terms of purchase have been based. With respect to the underground works, I have made such inquiries, and have inspected such maps as have been sufficient to enable me to express the opinion that these also are adequate to the purposes for which they were designed, and that it is not likely that they are otherwise than in the satisfactory state of the visible structures and machinery.

"I have to add that the commercial value of the undertaking, with its prospective advantages, is quite equal to the amount provisionally agreed upon between the company and the corporation.—I have the honour to be, &c.,

(Signed) "T. Hawksley."

Previous to the commencement of this discussion, Alderman Silverthorne explained that he did not intend to take part therein, nor to vote, as he was a shareholder in the water company.

Mr. Friend: then moved the adoption of the report of the Works Committee. In doing so he first dealt with the main question whether it was desirable for the town to purchase the water company or not. He did not believe that either the council or the town doubted for a moment that this proposed transfer would be of advantage to the ratepayers. This then admitted, the next business was to decide on the best way of dealing with the matter. The Works Committee, to whom this important question had been entrusted, had consulted one of the most eminent engineers in the country, who had been engaged in almost every transfer of a water company to a corporation. Both this gentleman and the parliamentary agents, who had necessarily had great experience in these matters, assured the committee that there was not the smallest chance of Parliament allowing the corporation to enter into competition with the present water company, as had been suggested. Nor would a private speculation, in opposition to the existing company, fare any better, while the existing company offered no weak point in the shape of any considerable inefficiency. Nor would such a scheme obtain the support even of the inhabitants, unless it could be shown that there would be better water or a better supply, or at a less price; and this was not likely, seeing that the present company had possession of the only two available sources of supply. The next question to consider was as to the advantages the ratepayers would derive from the transfer.

Alderman Martin: None at all.

Mr. Friend was ready to admit that the first year there would not be any profit, but the next he believed there would be a substantial revenue, which would gradually progress till it would materially help in reducing the rates. Of course, part of the profits would be spent in reducing the water-rate, but this reduction must not be expected immediately, nor did he believe that it was expected. But, besides these, there were a number of other minor and incidental advantages, which should not be lost sight of. The meters for the water-carts would be no longer wanted; the large and increasing quantity of water used for the urinals, for the drains, &c., would be obtainded at one-fifth the present price (1d. instead of 5d. per 1000 gallons). When the intercepting sewer was completed, a very large amount would be saved in this way.

A Voice: When!

Mr. Friend: He believed also that this transfer would be a considerable inducement to outlying districts to apply for incorporation with the borough. Now with regard to certain objections that had been raised. It had been stated that the £27,000 mortgage which would have to be taken, would be added to the borough debt, and this was considered a disadvantage; but, for his own part, he wished it had been twice as great, for if it had not existed, the share capital, which had to be bought, would have been proportionately increased. The price to be paid for the £10 share, paying 7 per cent., was £16, which he considered a fair and reasonable sum for both parties, remembering that these shares already fetched £14 in the market, and that the company were allowed to pay 8 per cent. as the maximum. It was unreasonable to suppose that because they were going to pay more for a property than it originally cost, that they were therefore going to pay more than it was now legitimately and honourably worth. In conclusion, he asked them to consider this momentous question calmly and dispassionately, and then he believed they would adopt this report.

Alderman Bowdidge seconded the resolution.

A long pause here took place, and just as the chairman was about to ask if any one had anything to say before putting the motion,

Alderman Lester rose, and moved an amendment to the effect that it was inexpedient to adopt the report. It was purely a commercial question, and without any disrespect to the Works Committee, he did not think that the negotiations had been conducted in a business-like manner. For instance, who was to know the state of the underground mains and pipes? Ought not some examination to be made? It had been stated that they required renewing once in 40 years, but some said more frequently, and it might be found that they were nearly worn out. It appeared that the mains, in some places at least, were not of an adequate size in case of fire, and there was no provision made for duplicate engines, &c., though the surveyor, in his first report, seemed to think these extremely desirable. As to the price, he thought that they should not take the last year's dividend, but the average of the last few years, which would make a great difference. He believed that the supposed enthusiasm out of doors would be greatly diminished, when it was found that the present charge for water would still have to be kept up.

Mr. Brigden seconded the amendment.

Mr. Davey supported the amendment on the grounds urged by Alderman Lester. He believed that the committee had gone to work in the wrong way. From the statement presented, he did not see that the town would be any the better for the transfer for a good many years to come. Why not let the company pay 8 per cent., and then reduce the price?

A Voice: They wont.

Mr. Davey: Then, perhaps, some pressure might be put upon them.

Mr. Duddell, in the course of a long and rambling speech, warmly and energetically condemned the report as not being either lucid, explicit, or satisfactory. To adopt it would doubtless be highly advantageous to the company, but it would be ruinous to the town. The public expected an immediate reduction in the water-rate, while certainly if these terms were agreed to they would not get it for many years. Nor was a word said as to how this enormous outlay was to be raised, and it was taken for granted that the loan could be got with ease, while it would certainly involve a very large cost. The heavy debt to be taken over would probably cause a great deal of litigation before the end of the 70 years; but this and many other expenses were forgotten, while it was assumed that the corporation would be able to conduct the concern very much more cheaply than such men of business as the directors. If the supply should prove to be inadequate to the increasing necessities of the town, the inhabitants could compel the council to afford an efficient supply; or, perhaps, for aught the report showed, a company might be formed to tap the present underground passages. Mr. Duddell concluded by ironically congratulating the committee on the result of their labours, having so successfully shown the admirable position and arrangements of the company. He incidentally mentioned that when having a pipe laid to a boiler, he was informed that pipes laid in chalk wore away much faster than when in other strata.

Mr. Pierson thought that an affair of such magnitude ought not to be settled without the direct sanction of the town at a public meeting.

In reply to Alderman Abbey, the Town-Clerk stated that the committee were informed that the company had paid first 5, then 6, then 6½, and now 7 per cent., but the exact annual dividends were not furnished.

Alderman Abbey said it was a question of now or never, and he hoped the council would adopt the report.

After a few remarks from Mr. Newman,

Alderman Hallett rose to reply to the observations of Mr. Duddell, who, he said, was much more fond of public talk than of hard work; and he advised him, in future, to take the trouble to verify his statements before he made them. He had taken the trouble to test the figures given by that gentleman at the previous afternoon's meeting—(this was a special meeting of the council)—and found that they were calculated to convey an entirely false impression; while, in particular, he complained of the want of candour manifested by Mr. Duddell in arguing the question. Alderman Hallett was proceeding to ridicule Mr. Duddell's comparison of hot with cold water pipes, as every one knew that hot water affected pipes more than cold, when

Mr. Duddell explained that he had said nothing about hot water pipes; but that pipes passing through chalk were likely to wear away quicker than if they passed through any other strata.

Alderman Hallett maintained that Mr. Duddell had mentioned hot water pipes, and said it was evident that he had been talking about a subject upon which he had not taken very great pains to inform himself. After showing, at some length, that the allowance of £8000, for the average expenses of the undertaking, was a fair one, the alderman went on to show that even if the gains of the company were more than 8 per cent., they would not be compelled to apply the surplus to the reduction of the water-rate, as they might devote it to paying up arrears of all previous dividends under 8 per cent., and also to increasing the salaries of the directors. They had been charged by one of the supporters of the amendment with being actuated by sentimental motives in urging the acquirement of the water company's works; but this, he showed, was nothing of the kind, and quoted from the reports of several Royal Commissions, recommending that the control of such companies should be in the hands of local governing bodies. With regard to Mr. Duddell's assertion that the town were about to be taxed to the tune of £15,000 per annum, that was manifestly both wrong and unfair, as the income they would derive from the water-rates would amount to no less than £13,000 of that sum. And it should also be remembered that the rentals were on the increase; in fact, they might be expected to increase at the rate of £700 per annum in a few years, as they had done in some years previously

Alderman Brigden, although accepting the report of the committee as substantially correct, could not agree with the conclusions arrived at by the committee, and he thought it would have been much better if they had embodied a little more information in their report. For instance, they might very well have ascertained whether or not the Shoreham Water Company could supply them with water. He certainly could not vote for the laying out of so large an amount of money without further consideration.

Mr. Mayall said he was one of the first to suggest the advisability of the town acquiring the control of the water supply, and the carrying out of that object was one of the chief reasons why he was sent by the burgesses of his ward to represent them in the Council Chamber. It was a question on which they ought not to decide too precipitately, either one way or the other, and he asked them, therefore, to look at it from the two points of view—first, whether they should purchase the plants and works of the present company, either by arrangement or by compulsory powers from Parliament; or, secondly, whether they should start a new and independent supply of their own. Parliament never yet disregarded anything of its own creation; and it would not allow the present company to be extinguished, therefore, except on the principle of paying them its full value at the time the negotiations were concluded. And supposing they acquired compulsory powers for its purchase, he did not think that the terms they would get would be more favourable, or even so easy as those which were now voluntarily offered to them. This was a point which required their careful consideration. Alderman Brigden appeared to be very dissatisfied with what he might term having to pay 25s. for £1; but he forgot they had nothing to do with what the works of the company had originally cost, but what their present value was in the market. The principle upon which Alderman Brigden argued simply amounted to a desire to get something for nothing. Now he thought the Water Company were perfectly justified in asking the corporation the worth of the concern in the marktet. Alderman Lester had struck out one or two points which deserved attention, and particularly his suggestion that the property should be inspected prior to its being purchased by the corporation, in order that the ratepayers might suffer no loss. Let them now consider for a moment the alternative proposal—namely, that they should have nothing to do with the present company, but should go to Parliament for powers to create a new company to draw upon a fresh supply of water. In this, of course, they would be opposed by the existing company, so that they would have to fight the question. The legal expenses alone would be considerable, and the present company having the whole of the surrounding watersheds in their possession—and they might rely upon it that Parliament would not allow them to tap them—they would have to go much farther afield in order to get a sufficient supply for the town. From Horsham, for instance, they might get an adequate supply of good water; but then such a project as that would cost something like £250,000. And what effect would this have upon the ratepayers? Why, they would be for ever committed to the interest upon that money. Because it must be remembered that the present company would be a competitor with their own, as the Town Council would have no power to compel the townspeople to use their water. Such a course, therefore, would only have the effect of sinking any profit which might arise from there being only one company, Some gentleman had urged that it would be wiser to let the present company go on and pocket the proceeds as hitherto. He, however, considered that it would be a most fatal thing if they allowed the present opportunity to slip. The report of the Works Committee had been characterized as meagre, and burking the question. It was quite the reverse of this, and must be clear enough to any one who would take the trouble to analyze it. He took it that the increase in the value of the property was £10,000 annually; so that every year that passed would enhance its value, and make it more expensive for them should they decide not to purchase it now, but wish to do so another time. But if they acquired it now, instead of there being an annual charge upon the property, there would be a profit, though slight, even for the first year. The second year the profit would be £500, and so it would go on. It should also be taken into account that there had been many disastrous commercial failures during the past five or six years, and this had in some measure, retarded the progress of Brighton. But now a larger prosperity than ever might be looked forward to for this town, and consequently there would be a larger demand for water. The machine it was proposed to purchase was already in efficient operation, and was spread all over the town; and instead of

estimating the increase of rentals at £500 per annum, he thought, in a few years, they might safely reckon upon something like £775. But even limiting it to £550, they would, by purchasing the control of the water company now—and surely 70 years was not an unreasonably short time to clear off the debt—be accumulating a capital sum of £10,000 a year. And what might such an instrument become in the hands of the Town Council! The present company had brought themselves to their present pass by their parsimonious conduct. They had charged the maximum of expense for the minimum of supply. At present the town paid the company £1000 for watering the streets, &c.; were the supply of water under their own control, it could be done for a fourth of the cost. And even allowing for the extra water used in flushing the sewers and for cleansing the town—for he hoped that sanitary matters would be better looked after than they had been—there would still be a saving, which would increase every year. It should be one of their chief aims—in fact, a sort of patriotism—to make the town as beneficial, healthy, and clean as they possibly could for the attraction of visitors, for the simple reason that visitors are the great capital of the town. And how greatly would it enhance the value of the schools in the town when parents knew that it was the principal object of the local governing body to do everything in their power to promote the healthiness and purity of the place. Thus, in a double sense, the money expended by the ratepayers would come back into their own pockets, True, they might be giving the company some £50,000 or £60,000 more for the property than they had given for it; but that, in his opinion, was not one penny more than it was at present worth, or that Parliament would insist upon their paying if they applied for compulsory powers. He therefore thought that it would be a most degrading thing if the council considered they ought to adopt the *laissez faire* principle; and he could not sit down without protesting against the principle that they had nothing to do in the world but to levy taxes, spend the money, and hear nothing more about it.

Alderman MARTIN was strongly opposed to such an enormous sum being given simply for the sake of the water company changing hands.

Alderman SMITHERS thought the whole matter resolved itself into this—whether they should have the water company or not. This really was what their decision would amount to. The sum asked by the company was, in his opinion, a fair and reasonable one; and he felt sure that if the council rejected the present offer they would regret it in years to come. Even supposing they did not themselves gain any material benefit from the change, there could be no doubt that their children and grandchildren would profit very much by it.

Mr. TAAFFE supported the Works Committee, considering that though they gave £2 in excess of the market value of the shares, it was simply a *quid pro quo*. He thought that the fact of the council having the control of the water supply would have a good effect in two ways—it would improve the sanitary condition of the town, and they might beautify it by the erection of fountains in the squares and enclosures.

Mr. REEVES suggested that the best thing would be to refer the report back to the Works Committee in conjunction with the General Purposes Committee, and urged Alderman Lester to withdraw his amendment in order that this might be done.

After a few remarks from Mr. BRIGHT, Alderman LESTER, with the consent of the council, but not without considerable opposition from Alderman Martin, withdrew his amendment; and Mr. WOOLLETT seconded an amendment to the effect that the report should be referred to the Works and General Purposes Committee. This the MAYOR was about to put, when

Mr. FRIEND insisted on his right to reply; but a number of the members of the council—tired of the discussion, and being decidedly averse to its being longer continued—rose at this moment to leave the chamber; and Mr. Friend, being unable to obtain a hearing, resumed his seat, and the amendment was carried; or at any rate was understood to be, for it appeared that there was some doubt about it after all.

A Special Meeting of the Town Council was held on Friday last, Dec. 15, to receive the report of the joint committees—the MAYOR (Mr. Cordy Burrows) in the chair.

The committees reported that they concurred in recommending the confirmation of the previous report of the Works Committee as to the purchase. They also presented a statement of the receipts and payments of the water company during the last 15 years, showing a balance of receipts over expenditure, increasing from £3035 in 1856 to £8474 in 1870.

Appended to the report of the two committees was a report from the borough surveyor as to the condition of the pipes and mains of the company. He states that he has seen them frequently during the progress of the drainage and other works, and believes them to be in good condition, and likely to remain so for many years. The total length of the mains and delivery-pipes (there are two sets in each street—one for constant, the other for intermittent service) he estimates at 250,000 yards, varying from 3 to 18 inches in diameter. This report concludes by detailing the heights of the reservoirs above low-water mark, stating that from them any required pressure can be obtained.

On the motion of Alderman COX, seconded by Mr. FRIEND, the report was adopted, and referred back to the committee to carry into effect.

THE WATER SUPPLY OF EDINBURGH:

IMPORTANT JUDGMENT OF THE COURT OF SESSION AS TO PAYMENT OF COSTS OF PROMOTING BILL IN PARLIAMENT.

On Tuesday, Dec. 5, the LORD ORDINARY (Lord Gifford) issued a decree in the interdict case against the Water Trustees, prohibiting the trustees from paying the expenses of promoting the St. Mary's Loch scheme in Parliament last session out of the funds of the trust, and ordering the respondents in the suit to pay the costs.

The following is his lordship's judgment, with his reasons appended thereto:—

"*Edinburgh, December* 5, 1871.—The Lord Ordinary having heard parties procurators, and having considered the closed record, statutes founded on by the parties, and whole process, recals the interdict granted *ad interim* by the interlocutor of 31st of August, 1871: Suspends the proceedings complained of, interdicts, prohibits, and discharges the respondents in terms of the prayer of the note of suspension: Declares this interdict, now granted, to be perpetual, and decerns: Finds the suspenders entitled to expenses, and remits the account thereof, when lodged, to the auditor of Court to tax the same, and to report.—AD. GIFFORD."

Note.—This is a very important case, involving large sums, and the decision of which adversely to the respondents may give rise to serious questions of personal responsibility.

The case is also one of very general interest as affecting the duties, powers, and responsibilities of public and statutory trustees. The entire *bona-fides* of the respondents in their whole actings was very strongly pressed on the Lord Ordinary, but he has not been able to find that mere *bona-fides* on the part of the trustees is sufficient to exclude consideration of the great question—whether the costs and expenses of promoting the bill to obtain a supply of water from St. Mary's Loch are or are not to be defrayed from the statutory funds in the hands of the respondents, as trustees under the Edinburgh District Water-Works Act of 1869.

The respondents in the present case are the trustees under the Act of 1869—the whole body as a corporation, without any distinction of minority or majority, the statutory trust which, though fluctuating in its members, is permanent in its constitution, appears as respondents; and the question is competently raised by two ratepayers within the district whether the costs of promoting the bill, which was lost by the decision of the House of Lords' Committee last session of Parliament, can be lawfully defrayed out of the assessments which the trustees are authorised to levy. The question the Lord Ordinary is bound to decide, apart altogether from the ulterior questions, upon whom these costs or any part of them will fall in the event of its being found that they are not chargeable against the assessments.

The Lord Ordinary has given the question raised in this action the most careful consideration in his power. In his view, it turns entirely upon the construction, meaning, and effect of the statutes held by the respondents, including not only their own Act of 1869, and the statutes incorporated therewith, but also the whole series of prior Acts which were obtained by "The Edinburgh Water Company," in whose right and place the trustees now stand. These Acts are very voluminous, and it is not easy to determine the exact import and effect of many of their provisions.

On the whole, and after the best consideration in his power, the Lord Ordinary has come to the conclusion that the costs of St. Mary's Loch Bill promoted in last session of Parliament do not constitute a proper charge against the assessments levied or to be levied by the respondents. He has come to this conclusion, however, not without great hesitation and difficulty, and, he is free to add, not without regret and reluctance; but he has felt himself bound to apply a strict rule, which, although it may often be productive of hardship, and may be so in the present case, is still, he thinks, upon the whole, salutary and beneficial.

In the debate before the Lord Ordinary there was not much conflict between the parties as to the *general principle*, or the *general rule of law*, applicable to cases like the present—the great contest and the great difficulty arises in the application of an admitted principle to the peculiar circumstances of the present case—to the position of the respondents as trustees, and to the duties incumbent upon them as such.

In general, it may be said that trust funds can only be applied to trust purposes: that in every case the powers of trustees are limited by the constitution of the trust, and that they cannot divert the trust funds, or any part thereof, to purposes either opposed to or different from the purposes for which the trust was created. Of this principle there are multitudes of illustrations, applicable to every different kind of trust, but it is always in each case a question—What is the real purpose of the trust, and what are the powers incidental thereto which are either expressly or by implication vested in the trustees? and to determine this question the nature, constitution, and circumstances of each particular trust must be looked to, and as these vary in each case, the general principle will vary in its application.

In all cases, besides the powers *expressly* conferred upon trustees, there are many powers which are held as *implied*, and which, from their nature and variety, must almost necessarily be left to implication, and the real difficulty often is to draw the line, and determine the limit, of these implied powers; and when the power claimed and exercised by trustees is peculiar or abnormal in its character, the difficulty is greatly enhanced, and very careful consideration may be required to determine whether it is or is not fairly within the trust.

Now, the promoting or opposing a bill in Parliament may be said to be in some respects an extraordinary act on the part of trustees. Not that it is an uncommon or unusual thing for trustees to do, for trustees of various descriptions both promote and oppose bills in Parliament every day, but the procuring of *new legislation*, or of powers which the Legislature alone can give, is not, in general, an object for which a trust is constituted; and unless there be express power to go to Parliament, it will require in general a pretty strong implication to justify trustees in doing so at the expense of the trust.

When the object of the bill promoted by the trustees is to obtain an increase or alteration of *their own powers*, or to change or subvert their own constitution, a strong case must be made out before the expense of such an unsuccessful attempt can be charged against the proper trust funds. For it can never be presumed that trustees are appointed for the very purpose of altering, amending, or it may be entirely subverting, their own powers and constitution. This point will be afterwards noticed, when considering the special nature of the respondents' trust.

It may be useful before adverting to the specialties of the present case, to consider a few of the leading cases which have been decided relative to the powers of trustees to promote or oppose parliamentary measures. These cases are referred to merely as illustrations of the general principle above stated, and which the Lord Ordinary thinks must regulate the present question.

In the *Attorney-General v. the Guardians of the Poor of Southampton*, 23d May, 1849 (18 *Law Journal*, Chancr. 393), the Guardians of the Poor of Southampton applied for an Act of Parliament to vary the mode of assessment, and to authorize the rates on small rents under £12 to be levied from owners instead of occupiers. The bill was lost, and the court held that the guardians could not charge the costs thereof against the poor-rates under their charge.

In the *Attorney-General v. Andrews*, 24th Jan., 1850 (19 *Law Journal*, Chancr., 197), the Commissioners of Water-Works of Southampton applied for a new Act extending their powers. Twenty of the commissioners were in favour of promoting the Act, and only two opposed it. The court held that, although the new Act might be very desirable, the cost of promoting it could not be defrayed out of existing rates. This is a strong case, for the existing Act empowered the commissioners "to increase the supply of water by such means as they should think proper, and to do and execute all such matters and things as should be necessary for that purpose."

Attorney-General v. Liverpool (1 Myl & Craig; 7 *Law Journal* Chancr., 51.)

Attorney-General v. Norwich (16 Simon, 225.)

Stevens v. South Devon Railway Company (16 January, 1851, 20 *Law Journal*, Chancr., 491.)

In *Taylor v. Chichester Railway Company*, 24th June 1867 (Law Reports 2, Exchequer, 337), a railway company in order to buy off opposition to an Extension Act agreed to pay a landowner £2000. The Act passed, but made no provision for this payment. Held by Exchequer Chamber that the £2000 could not be paid from the funds of the company.

Miles v. M'Ewan, 13th January, 1855, 18 D. 205. Here the Commissioners of Police for Dundee applied for an Act to prolong their powers. The Act was opposed, and after incurring about £1000 of expenses was abandoned, and the General Act adopted by a majority of householders. The court held that, although the commissioners had applied for the Act in *optima fide*, the expense could not be charged against the police funds.

See Brown v. Adam, 19th Feb., 1848, 10 D. 744.

M'Lean v. Mackintosh, 30th June, 1852, 14 D. 928. Here the magistrates of Inverness who were trustees of the Mackintosh Educational Fund applied for an Act to unite the fund with the funds of the Inverness Academy under a joint trust. The bill was opposed, and the committee of the House of Lords gave an adverse opinion, whereupon it was abandoned. Held that although the expense of opposing the bill had protected the trust funds they could not be charged against these funds.

Brighton v. North, 13th Feb., 1847 (16 *Law Journal*, Chancr., 255). Here the trustees of the banks of the river Ouse were found entitled to the costs of opposing a bill which would have injured the river's banks. The Lord Chancellor Cottenham explaining that every trustee is entitled to the fair expense of defending the trust property.

The same principle was recognised in Campbell, petitioner, 12th Jan., 1847, 9 D. 397; *Mill v. Fraser*, 25th Nov., 1859, 22 D. 33; *Regina v. Norfolk Commissioners of Sewers* (20 *Law Journal*, 2 B. 121); *Vance v. East Lancashire Railway*, 3 K. and J. 50.

There are various other cases, most of which will be found referred to in the judgments above quoted.

The principle fairly to be gathered from these cases appears to be that in each case it must be shown that the parliamentary costs were incurred in the exercise of powers, either expressly or by clear implication, conferred upon the trustees. It seems farther that the expense of opposing a bill will be more easily admitted as a charge upon the trust funds than the expense of promoting a bill—at least where the opposition to the bill is for the purpose of protecting the trust estate.

Applying these principles to the present case, the Lord Ordinary thinks, on a consideration of the whole statutes held by the respondents, that the respondents' trust was not constituted or created for the purposes of obtaining new or additional supplies of water—that is, new sources of supply; but solely for the purpose of administering the existing supply—that is, the supplies and sources of supply which by the statutes are now vested in the respondents He has consequently felt himself compelled to disallow as a charge against the trust—that is against the assessments which the respondents levy—the costs of the unsuccessful measure which the respondents promoted in the last session of Parliament.

Avoiding all detail and all minute criticism of clauses, the Lord Ordinary will shortly indicate the grounds upon which his opinion rests.

(1). The Act of 1869, under which the respondents are incorporated, does not by any express provision authorize them either to bring in new sources of supply, or to make application to Parliament for powers to do so.

Of course, this is by no means conclusive, for in such a trust many powers must be *implied*; but it is, to say the least, very remarkable that if, as was contended, one of the *primary duties* of the trust was to get more water, not one word about this should be contained in the statute. The getting additional supplies, or the obtaining of statutory powers to do so, were and are very important matters, involving very large costs and expenses; and if it was intended that the trustees should either get new supplies, or apply for powers to get them, it is natural to expect that this would be specially provided for in their Acts. But neither in the Act of 1869, nor in any of the statutes incorporated therewith, nor in any of the Acts of the old company, is there any provision authorizing the course which the trustees have recently adopted. The preliminary expenses of obtaining a new Act may often be, and in the present case, very large. Surveys by engineers, and estimates for works more than forty miles long, and of great magnitude, had to be obtained. Numerous conflicting interests had to be provided for, preparations had to made for opposition, which was sure to be offered, and an expensive parliamentary contest had to be engaged in. It is strong to hold that all this is to be held as authorised merely by implication when a single clause or a single sentence in the Act of 1869 would

have removed all doubt and all difficulty. In this respect, the case of the present respondents is much weaker than that of the Southampton Water Trustees, for in that case these trustees had general powers to *increase* the supply of water.

(2.) The respondents Act of 1869 does not even narrate that the supplies or sources of supply thereby vested in the respondents were insufficient or inadequate, or that it was expedient to get further or additional supplies. Some such narrative as this would have been natural if the intention of the Legislature had been that the trustees should set about getting new supplies, and preparing and promoting bills for that purpose.

The absence of any allusion to the deficiency of supply is the more remarkable, when it is remembered that the bill of 1869 originally contained powers to bring in St. Mary's Loch, and that that part of the bill contained an inductive clause that more water was needed; and it is to be noticed that in all the previous Acts of the old company, whenever powers are granted to bring in new springs, the statutes themselves narrate the necessity or expediency of new supplies.

(3.) It is true that there are some expressions in the Act of 1869 which might point to additional supplies. For example, the title of the Act bears *inter alia* to be "for supplying water." The inductive clause of the Act bears that "the supply of water should be provided by" the trustees, &c. These expressions, however, are ambiguous. They may mean either "supplying" and "providing" *from existing sources* handed over to the trustees, or from *new sources* not yet obtained; and the Lord Ordinary thinks, on a purview of the whole statutes, that the former meaning is that truly intended. It is thought that an ambiguous expression must be interpreted by the unambiguous parts of the statute.

(4.) The vesting clauses of the statute are confined to the estates, subjects, and sources of supply which belonged to the old company, and it is one of the inductive clauses of the statute that it is expedient to transfer the old undertaking to a new and a public trust. Indeed, the statute expressly refers to the provisions which the old Acts contain for this purpose, and states that the said provisions were "unsuited to existing circumstances," and the fair reading of all the statutes seems to be that the old undertaking is simply to be placed under new and better management. Additional powers, no doubt, may be and are expressly conferred upon the new trustees, but all this is only for the administration and management of *the old estate*.

(5.) And this leads to the remark that the old water company had no express power by any of their statutes to promote bills in Parliament, or to get up schemes for obtaining new sources of supply, and no such power seems to be implied in any of the old Acts.

It is true the old company had occasion to come very frequently (six or seven times) to Parliament, and on several of these occasions got powers to bring in new supplies, and it was very ingeniously urged that the new trust will just have to follow the same course. But all the old company's Acts specially provide for the costs thereof. It rather appears to be a begging of the question to argue that if the old company had lost any of its bills the expenses thereof would have been a good charge against opposing or objecting shareholders. The Lord Ordinary thinks that if any such question had risen, protesting shareholders might have successfully resisted payment from their funds of the cost of promoting abortive bills brought in by the directors or their majority. Such question would be very similar to that now raised, and there is abundant authority for holding that the directors of a railway or other statutory company, cannot charge against resisting shareholders the expense of unsuccessful attempts to promote new and different lines of railway.

Indeed, the principle restraining directors or trustees from going beyond the powers of their Act or charter or contract is in general of clearer application in the case of a private company than in that of a public trust. It is easily conceivable that a person might be willing to take shares in a company for bringing in the Crawley springs who might shrink from taking shares in a company for bringing in St. Mary's Loch, and it would be most unjust if money subscribed for a limited purpose should be diverted in order to involve the subscriber in the responsibilities of a different, and it may be, gigantic and hazardous undertaking.

(6.) The respondents, by their statutes, have no power to make new works for bringing in new supplies, but have merely power to make and maintain works for distributing the existing supplies.

The "Waterworks Clauses Act" of 1847 is incorporated with the respondents Act of 1869, but there is specially *excepted* "*all provisions with respect to the construction of water-works.*" Nothing could more strongly show that the respondents are not to bring in new supplies than that they have no power to make new works for any such purpose. It was said that the construction clauses of the Act of 1847 were not applicable, and that therefore they are excepted. But if this were the only reason, other or substitutional powers would be given. But no such powers are conferred at all, and the inference is irresistible, that it was the existing sources of supply, and not new sources, which the statutory trust is to manage and administer.

(7.) The same result follows from a consideration of the *funds* which the respondents are authorized to raise. These funds consist of, first, sums which the trustees may borrow; and second, sums which they may raise by assessment. The borrowing powers are conferred by section 79, but moneys, borrowed are only applicable to three purposes—first, the mortgage debt of the old company, and the sums payable to the old company; second, the expense of renewing "main pipes and conduits;" and third, the expense of laying "additional service-pipes." It was conceded in argument, and seems pretty clear, that the respondents could not apply moneys borrowed either towards bringing in new supplies of water—that is, supplies from new sources—or towards the expense of bills promoted for that purpose.

The only other funds at the disposal of the respondents are the annual rates and assessments which are authorised by section 65 and following sections. Now, these assessments are only applicable to *annual charges and expenses*, or, as it is expressed in the Act itself, to sums "*chargeable against revenue.*" But the expense of a new Act for bringing in St. Mary's Loch, and of all the engineering and other surveys necessary, can hardly be said to be a proper or equitable charge against capital. They would have been part of the expense of the new supply, just as much as the reservoirs or embankments necessary for bringing in that supply, and it would be rather hard to assess the ratepayers of any one year for the costs and expenses of a measure intended to serve all time coming.

In the bill promoted there was a special clause authorizing the expenses of the Act to be paid either out of the rates or out of moneys borrowed. The Lord Ordinary does not attach much importance to this clause, although in some of the decided cases it was founded on as a reason for disallowing the costs of an unsuccessful Act. But it seems a fair subject for consideration whether, apart from any special clause, the costs of an Act, if obtained, or a bill unsuccessfully promoted, form a charge against capital or against revenue.

Great stress was laid by the respondents upon the very broad terms of the 65th section defining the purposes to which the annual assessments are applicable, and no doubt the enumeration is very wide and comprehensive. It must be borne in mind, however, that the costs now in question do not fall under any of the heads specially mentioned in the 65th clause, and general expressions, such as "other outgoings and charges" and "other charges and expenses" must always be interpreted with reference to the charges and expenses specially enumerated.

But besides this, the general question always returns, Are the expenses now claimed *authorised* by the Act either expressly or by implication? for no generality of expression occurring in a clause like the 65th can ever authorize the trustees to divert the trust funds to purposes not authorized by the statute.

(8.) One great difficulty—indeed, it may be said *the* great difficulty—in the case, arises from the duties imposed on the trustees by statute, and the penalties to which the trustees or the trust funds may be subjected for failure to discharge these duties.

By section 35th of the Water-Works Clauses Act, the respondents are bound to keep in the pipes a sufficient supply of water "*constantly laid on under pressure*," and to lay down pipes to every district within the limits of the Act, provided an undertaking is given to pay, for three years, rates not less than one-tenth of the expense; and by sections 36 and 43 penalties are imposed for failure or neglect to supply water or to lay down such pipes.

The force of these clauses is intensified by the provision in section 4 of the respondents Act of 1869, that no penalties shall attach for a period of five years from the vesting of the undertaking in the present respondent, that is, for five years from Whitsunday, 1870.

The Lord Ordinary feels that these clauses do create great difficulty and embarrassment. They raise a very powerful argument in favour of the respondents, and they merit the closest and most anxious consideration.

Taking everything into view, however, the Lord Ordinary has come to think that all these clauses must be held to be conditional, and as having reference to the estate and supply at the command of the respondents. The duty on the respondents as *public trustees* must be measured by the means at their disposal. They can only discharge the duty in reference to the estate with which they are vested. This is expressed in clauses 36, 42, and 43 of the Water-Works Act, exempting from duty or from penalty when the undertakers are prevented from giving the supply by "frost, unusual drought, or other unavoidable cause or accident;" and although it was urged that the expression "other cause," when interpreted in reference to the preceding words, will not include permanent deficiency in the sources of supply, the Lord Ordinary thinks that this would be too rigid a construction when applied to the circumstances of the case. The penalties are imposed in the event of "*neglect or refusal*" to supply, and it is thought that there can be no neglect or refusal when the statutory means with which alone the respondents have to do prove insufficient.

It would be a very startling thing to hold that the penalties referred to, which, in their original intentions, were directed against *private companies*, which of course must see to their supply before they undertake statutory duties, apply absolutely and unqualifiedly to a *public trust* like the present. For the result would be, that in the event of a permanent inadequacy in the source of supply—an event which is said to have occurred—*every ratepayer*, without exception, would be entitled to penalties, and as the penalties can only be paid out of the rates, all the ratepayers would be assessed to pay penalties to themselves so far as the rates would go. The Lord Ordinary is not prepared to adopt an interpretation which would lead to this result.

Still further, on the respondents' own showing, they have only five years given them to procure an Act and bring in large additional supplies. But two years have already elapsed, and it is easily conceivable that other three years may pass without the respondents being able to obtain a bill. They may fail in other Parliaments as they failed in the last one, and even when an Act is got, time will be needed to bring in the water; so that, without the least fault on the part of the respondents, the five years might easily elapse without their having the means of avoiding the penalties. It would be a strong thing to hold that penalties are imposed upon a *public trust*, or rather upon the *public*, unless statutory powers are obtained, which powers the Legislature, in its wisdom, may not see fit to grant.

Without in the least disguising the difficulty, therefore, the Lord Ordinary feels himself compelled to interpret the penalty clauses as only applying to the case of the trustees failing or neglecting to use the means at their disposal.

This view is confirmed by other clauses, which, in quite absolute and general terms, impose upon the respondents the duty of supplying, for certain maximum rates, water to shipping, water to brewers, distillers, and manufacturers, and water for working machinery, and water for fountains and ornamental purposes. There is no condition expressed; the duty is in terms absolute; and a brewer or manufacturer, tendering the maximum rate, would have action to compel supply. But the Lord Ordinary thinks that the condition must always be held implied, "if there be sufficient water for such purposes." The trustees are surely not bound to go to Parliament merely to get water to play in fountains, or to drive machines, and this seems to be inferred from the expression in the 63d section, that water for shipping, manufacturers, machinery, and fountains is to be given after the trustees have supplied, from time to time, persons requiring water for dwelling-houses, shops, and offices. The idea of postponement in the order of supply implies possible deficiency, and it seems only fair that this condition should be held to run through the whole enactments.

The period of five years allowed by section 4 may possibly have reference to the *prevention of waste* by the respondents. By the Water-Works Act, the respondents have very large powers to check and prevent waste. The House of Lords, in throwing out the bill last session, gave their reason thus:—"They hold that, with better care and regulation as regards waste, and with increased storage for the utilization of water drawn from the present sources of supply, Edinburgh can obtain all that is requisite for her needs." In the opinion of the committee of the House of Lords, therefore, if waste is prevented, there will be ample supply, and it is not an unreasonable interpretation of section 4 of the Act of 1869 that five years were allowed for the adoption of those measures which would make the *existing sources* of supply ample and sufficient.

(9.) On looking at the bill promoted by the respondents, the Lord Ordinary observes that, among numerous new powers, power was asked to impose new and additional assessments. It is an additional reason for holding the promotion of such an Act to be *ultra vires* of the respondents that they were seeking to impose *new assessments*. The Lord Ordinary cannot hold that the Act of 1869, which empowered a limited and fixed assessment, authorized the trustees to use these assessments for the purpose of getting power to lay on extra assessments. This would be assessing the inhabitants for the purpose of getting authority to assess them still farther. It is thought that something very express would be required to authorize this.

Indeed, this is just a special illustration of the general principle already alluded to that *in dubio* trustees can never be held empowered to apply trust funds for altering, enlarging, or overturning their own constitution.

The Lord Ordinary will conclude with one general observation. It was strongly urged upon him that it was extremely expedient that a public body of trustees, like the respondents, should be invested with the power of seeking out new sources of supply of water, and of obtaining Acts to bring in new supplies therefrom. To this it is a sufficient reply that no such power has been conferred upon the present respondents, and that a power so great should not be held as conferred except by express legislative provision.

But the Lord Ordinary doubts extremely the expediency of vesting such powers in a public trust. The recent contest affords a very strong illustration of the hardships to which such powers might lead. A very large section of the community, claiming to be the great majority, opposed the bill promoted by the respondents, and what the respondents now seek is, that these opponents shall not only be left to pay the whole expenses of their successful opposition, but shall in addition be assessed in order to defray the expense of promoting the very measure which they defeated. Strong reasons of expediency might easily be urged why the expense of legislative proceedings and legislative contests should not be provided for by anticipation, but should be left to the Legislature itself, and to the public spirit and personal responsibility of the promoters.

The Lord Ordinary's judgment, however, is not rested on grounds of expediency, but on a special consideration of the respondents' statutes. The grounds of the Lord Ordinary's judgment would not in the least apply to bills promoted by Town Councils or by other bodies who hold funds dedicated to general or public purposes. All he has decided is, that the assessments imposed by the respondents are not applicable to promoting bills in Parliament for obtaining water from St. Mary's Loch.

Meeting of the Water Trust.

A Special Meeting of the Water Trust was held on Friday, Dec. 9, for the purpose of considering the course to be pursued in regard to Lord Gifford's decision in the Interdict Case—the Lord Provost presided.

After some preliminary discussion as to the desirableness of allowing the presence of reporters,

Mr. Archibald moved—"That, in order to enable the Corporations of Edinburgh, Leith, and Portobello to consider and determine what course should be adopted in regard to Lord Gifford's decision in the interdict case, the trustees resolve to lodge a reclaiming note to prevent the decision becoming final and the interdict perpetual." He said there were three very important questions involved in the decision. The first was the question of personal responsibility. There was no doubt whatever that, if the interdict was allowed to become perpetual, the next question that arose, and arose immediately and directly, was the personal responsibility of the trustees to make good the money. He would not say anything upon that branch of the subject just now, but pass to the second question, which was one of great importance—namely, the principle of constant service, and the application of penalties. The whole case of the trustees rested upon the true construction of this principle. The trustees believed that they were under an express statutory obligation to provide a supply of pure and wholesome water sufficient for all the inhabitants of the district, on the principle of constant service, and that should they refuse or neglect to provide such supply, they were liable in penalties. Lord Gifford's view of the question was to his mind something strange. The view his lordship took was that they were only bound to give what water could be obtained from their present sources of supply, and that penalties could only attach if they failed or neglected to give that supply. In dealing with the suspension of penalties for five years under the 4th section of the special Act, Lord Gifford quoted the decision of the House of Lords on the bill of last session that, if waste was prevented, there would be ample supplies. Now, his answer to that was, that if the mere prevention of waste had been the intention of the Legislature, there could have been no reason for suspending the penalties for five years. They were all aware that the only powers which the trust possessed in regard to preventing waste were the powers which the old water company had, and these might have been as efficiently put in force within the first six or twelve months that the trust was in existence as in five years. Then, again, Lord Gifford forgot in quoting the Lords decision that that decision had two parts. It might be truly said to point to the prevention o waste, but it was the prevention of waste in the town by better regulations and the prevention of waste at the reservoirs by increased storage. Lor Gifford ought to know that, by his own decision, the trustees had no powe whatever to increase the storage at the reservoirs—to enlarge the prese reservoirs or make new ones. But when his lordship travelled outside the A of Parliament to get reasons to bolster up his case ——

Several members rose to order, and after some discussion

Mr. Archibald withdrew the words "bolster up," because he did no

DIAGRAM SHEWING WORKING OF CENTRE VALVES

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Fig. 1

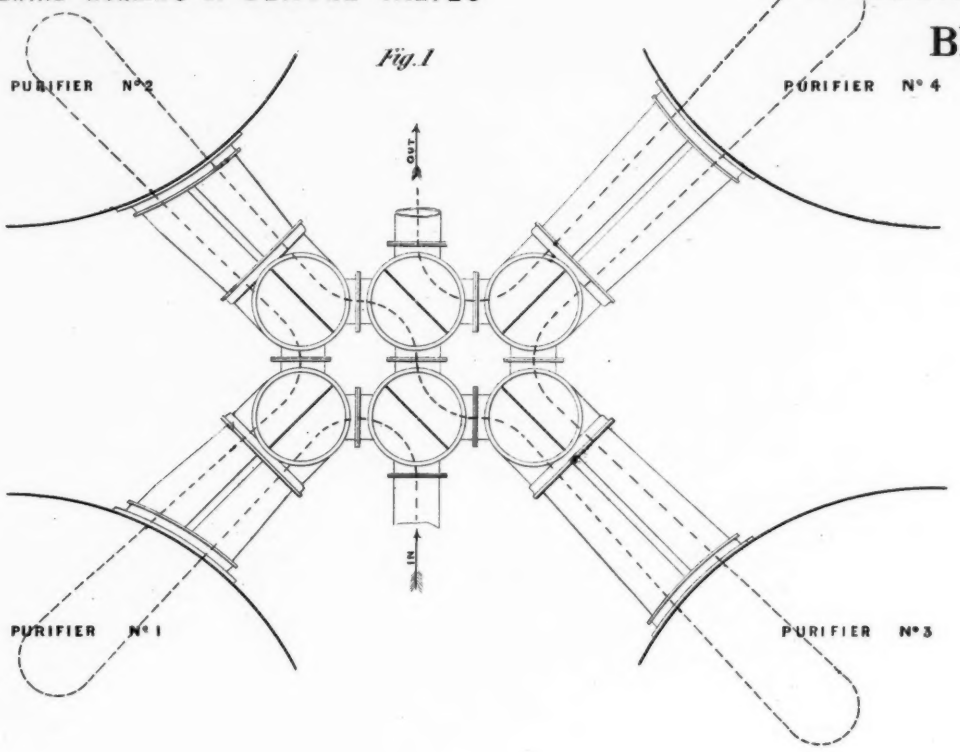

Fig 3

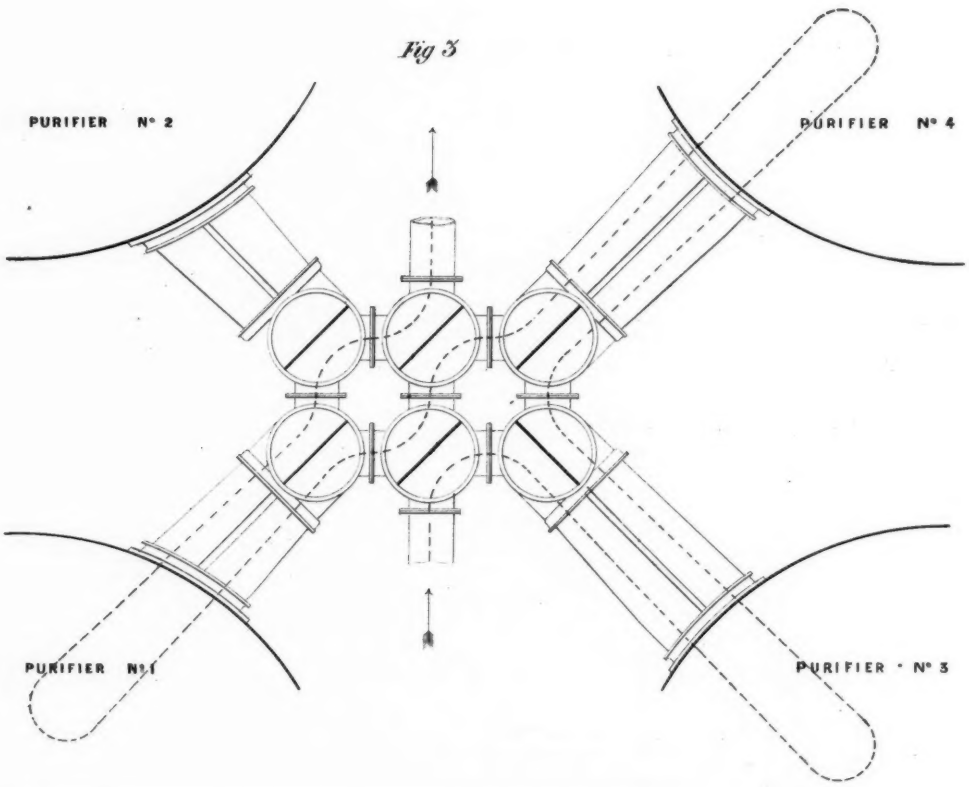

Photo-Lithographed by Whiteman & Bass London

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Fig 2

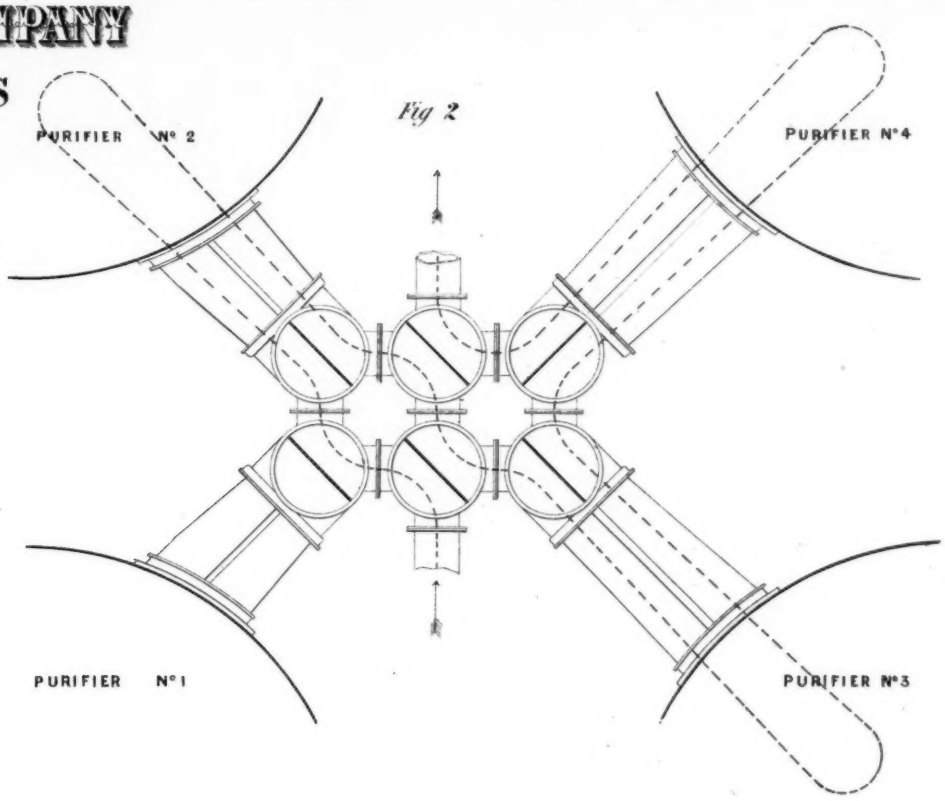
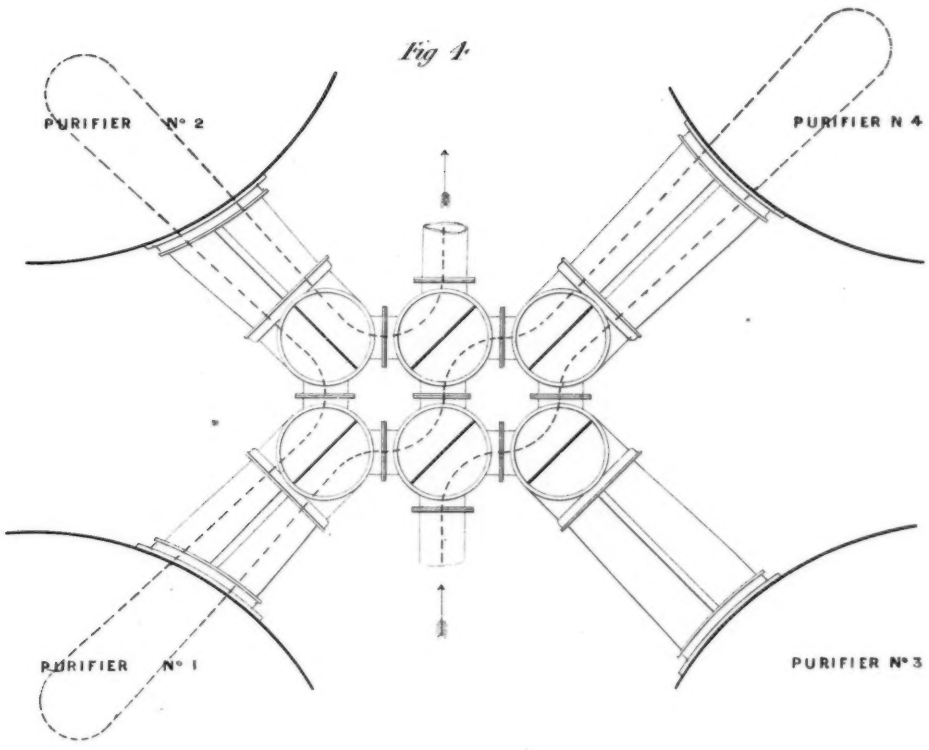


Fig 4



intend anything in the slightest degree disrespectful to the judge, but he repeated that in order to support his judgment his lordship had travelled out of the statute, and given a decision of the House of Lords which had no connexion with the case before him. It would have been more natural and more applicable had his lordship quoted the words in the bill which passed the Commons in 1869—namely, "Provided always that no penalty shall attach to the undertakers for not providing constant service or keeping the pipes constantly under pressure so long as their means of supply shall remain as at present." Had his lordship taken these words into consideration he would have seen it was not the mere checking of waste that was in question. What he submitted was, that it was not the mere checking of waste that was intended—that the trustees had power to check waste without going to Parliament at all. But suppose it could be contended for a moment that the checking of waste would give constant service for two or three years, it would not give constant service in all time coming. Every gentleman present knew that in 1875, if the population increased at the same rate as it had been doing during the last decade, there would be 20,000 more people to supply with water than there were now. If Lord Gifford was right in assuming that constant service was a myth, and that the trustees were only to give what they had got, then the Act of Parliament was a delusion and a snare. It was a delusion to the people, who were made to believe that they were to get water on the principle of constant service; and it was a snare to the Water Trust, who believed they were under an obligation to provide water on that principle. The 35th section of the Water-Works Clauses Act said that the undertakers—that was the trustees—should "provide and keep in the pipes;" and it was that word "provide" which constituted the trustees' whole case. If the word provide as there used meant simply to distribute water from the existing sources, they had no case; if, on the other hand, it meant to provide water so as to secure constant service from 1875 onwards, then their case was a good case. The position they were brought to was that, by Lord Gifford's decision, if it was a good decision, the trust had no powers whatever beyond distributing the water from the present sources. They had no powers to apply to Parliament to get more water; they had no powers to apply to get increased rates or to vary the rates, or to check waste, or to do anything—no powers whatever. Now, this was a very important matter for the trust. If the decision was a good decision, it was quite clear that the trustees could do nothing. Who, then, was to take action? Were they to trust to some Act brought in by the Lord Advocate? He thought not. But who appointed the trustees and brought them into the position they occupied? The Corporations of Edinburgh, Leith, and Portobello. If there was any defect in the Act of 1869 contrary to the intention and belief of those Corporations, it was they who must take the trustees out of the difficulty; and his motion pointed to this, that the trust should only put in a reclaiming note to keep the matter open for the consideration of those bodies. If that was agreed to, the Corporations would be enabled to meet to consider their whole position, to consider whether the case should be further appealed, or if not what other steps should be taken. The Corporation were in a position, if they thought proper, in conjunction with the trust, next year to reconsider the whole question of water supply; they were in a position to resolve to go to Parliament and promote a bill to get a supply of water, and in doing so they might resolve to put in a clause to cover, not only the costs of that bill, but also the costs of the bill of 1871. That, in his opinion, was the only practicable and safe road out of the difficulty.

Provost WATT, in seconding the motion, said he differed from Lord Gifford in regard to several things, and particularly to the clause enjoined upon the trustees providing for constant service. He thought that Lord Gifford's decision threw great responsibilities upon all trusts over the length and breadth of the land. It would be a very serious matter indeed for any trust to undertake the responsibility of going to Parliament, seeing that if the decision held, no trustees could go to Parliament and lose a bill without incurring personal liability. If the decision was to be carried out, it would be a very hard case for a number of the trustees—it would be perfect ruination to them; and surely that never was the intention of the community in sending them there, if they acted in an honest and *bonâ-fide* manner. No doubt at last there was a variation of opinion in regard to the matter, but at the first there was not a single whisper against the St. Mary's Loch Bill. If there had been from the ratepayers, or any one else, a whisper that the Act of 1869 did not empower the trustees to apply to Parliament, would they have been such fools as to go there and incur the liability to a pecuniary sacrifice? In what they did they only endeavoured to fulfil the duty that the Town Councils had imposed upon them.

Mr. WORMALD moved, as an amendment, that the trust resolve to take no action. He did so after very mature consideration. He did not think the trustees were in a position, he did not think it was their duty at all, to discuss the merits of Lord Gifford's judgment; they should confine themselves to the question whether they, as a corporation, now should carry the case further. He had given very careful consideration to the judgment, and he believed it to be perfectly sound, and he doubted whether they would get any other decision if they appealed to the Inner House or to the House of Lords. Looking at the matter, then, from his point of view, he regarded such an appeal as a waste of money; and whatever the public might be disposed to do in the way of relieving the old trustees, who were involved by the decision in personal liability, he doubted very much whether they would be disposed to relieve the present trust of unnecessary and needless and extravagant expenditure in litigation. He, therefore, recommended the whole of the trustees, even those who were formerly in the trust, to take no further action, and spend no more money in litigation; but try if they could not fall upon some plan to relieve the interdicted trustees of personal liability. He was sure he was speaking the sentiment of the whole members of the trust in saying that they were willing to do anything and everything in their power to relieve those gentlemen from personal liability. But if litigation was to go on, and if obstructions were to be put in the way of the business of the city simply because by this unfortunate decision certain parties had become personally liable for expenses, then the sympathy of those who were willing to help might be diverted into a different channel. If anything was to be done, it should be done by those on whose shoulders the personal liability rested. Of the £20,000 or there abouts, incurred by the late Water Trustees in connection with the bill, £5316 had already been paid out of the trust funds, and the present trustees, under Lord Gifford's judgment, might, if they thought proper, ask the late trustees to refund that sum. No doubt the personal liability of the old trustees applied to the sum already paid to account as well as to the sums that were due to different parties; but he thought that very likely his brother trustees would be willing to refrain from taking action in that direction until something was resolved upon as to what should be done in Parliament.

Mr. ARCHIBALD: But any other ratepayer could do it.

Mr. WORMALD said that any other ratepayer might do it if the matter was not in some way or other adjusted; but the question the trust had to consider was whether they should keep open the action, or whether the old trustees, on whose shoulders the responsibility rested, should not in their individual capacity do so. Eight days from the date of the judgment were allowed for reclaiming, and that step could be taken by the old trustees as well as by the present trust.

Bailie MILLER seconded the amendment. If, he said, the trust agreed to Mr. Archibald's motion, they would become parties to the litigation and responsible for the expense of it. Probably it might also involve the question of their liability for the £19,000. He for one should not place himself in a position where he should be made responsible for even defending the action; for if the trust once took up a false position, it was impossible to say where they might be dragged to before the case came to a conclusion. The chief argument on which Mr. Archibald had based his motion was that the trustees had been misled. If they were misled as to their duties, that was their own fault; they ought to have taken better counsel before they undertook such a grave responsibility as to apply for an Act of Parliament, if it was not clear that they were entitled to pay the expense, in the event of failure, out of the trust funds.

Mr. ARCHIBALD said he did not think he had used the argument referred to.

Bailie MILLER said the argument used both by him and Provost Watt was that the thing was a delusion and a snare. There was no delusion or snare about it. It was perfectly clear from the Act Mr. Archibald quoted first, that no penalty was to attach to the trust for a period of five years from the vesting of the undertaking in the trustees. Mr. Archibald went on to read a clause from the General Water-Works Act, showing that the trustees were bound to have a constant supply in the pipes, unless there was some statutory enactment to the contrary; but he forgot to read the 36th clause—"Provided always that the undertakers shall not be liable to any penalty for not supplying water if the want of such supply shall arise from frost, unusual drought, or other unavoidable cause or accident." Surely the Legislature never intended that those penalties should apply either to the Edinburgh Water Trust, or any other trust, if the ponds were dry from an unusual drought, or had become exhausted from the supply being defective, and if Parliament itself had refused them powers to get an additional supply. The whole argument seemed to him to be nonsense. The proposal of going back to the Corporations seemed rather a curious way of getting out of the difficulty. The three Corporations were no doubt the constituents of the trust, but those Corporations were simply the representative of the community, and had no more power to get the old trustees out of the difficulties they had got into than the community itself. The thing was done on the trustees own responsibility, and although there might be some show of reason in the argument used by Provost Watt, that at first the community were in favour of it—a statement which he (Bailie Miller) altogether denied—the fact was unquestionable, that before they had incurred one-half of the enormous expense in question, the public had decided in a most conclusive manner against their proceeding with the bill. Fully one-half of the expense was contracted in preparing to go to the House of Lords and in the contest in that House; and had the trustees obeyed the behest of the ratepayers before they went there, one half of the pecuniary obligations would never have been incurred. But they incurred those obligations in defiance and in contempt of public opinion, and he did not see that they had much to complain of should the ratepayers make them responsible for, at least, part of the £19,000. As far as he was concerned, he was disposed, if the thing could be amicably arranged with the consent of all parties, that the old trustees might, in certain circumstances, be relieved of the whole pecuniary obligations they had incurred; but that was a matter for consideration, and both parties must be satisfied as to the propriety and the expediency of doing so. But if the Lord Ordinary's judgment was to be brought up every now and again, to interrupt and put a stop to the working of the trust, then it would become a serious question with the trustees who were not involved, whether they should do much to relieve the members of the old trust from the effects of the interdict. At all events, the proposal to go back to the Town Councils was one that he could not, at the present stage of the proceedings, entertain. He found from examination of the books, that all the members of the trust who went to London as witnesses or on deputations had made sure of payment. He thought that, if there were any claimant creditors, those gentlemen might refund a portion, if not all, of what they had pocketed. Where agents had laid out money, he thought it would be only right and proper that those gentlemen who had pocketed their full expenses should refund the money to satisfy such claims until the matter had been arranged.

Mr. WORMALD said the agents had got payments on account.

Bailie MILLER said there were other professional witnesses who might have been out of pocket. This, however, was perhaps a matter that he had nothing to do with, seeing he was not going to pay. It was proposed, however, that he and others who had nothing to do with the matter should be made responsible for carrying on the legal process against the ratepayers. They were asked just to do what the late trustees did in the House of Lords to fight the public with the public money.

Mr. FORSYTH said that as to the trustees having incurred one-half of the expenditure in total disregard of public opinion, as far as Leith was concerned he most indignantly denied the accuracy of the statement. On every occasion—and there were many—on which he submitted the scheme to the ratepayers, they urged him, against his convictions, to go in for it, as being the scheme best suited to promote the manufacturing interests of Leith. The Town Council of Leith unanimously petitioned in favour of the bill, and when, after the bill had passed the House of Commons, he proposed to call a meeting to ascertain if there was any divergence of public opinion, the proposal was declined. As far as the Edinburgh representatives were concerned, it was a question between them and the public; but as regarded those of Leith, he could safely and honestly say that they had the great bulk of the people with them in promoting the measure up to the last day it was in the Lords. Bailie Miller had asked some of the late trustees to hand back the money they had received to pay the lawyers. The bailie had got £70 or £80 from the Ratepayers Association, which was some £3000 or £4000 in arrear. Let the bailie hand back what he had got, and he (Mr. Forsyth) would do the same.

Mr. WORMALD said the ratepayers did not require it.

Mr. FORSYTH was glad to hear that the people of Edinburgh had so much public spirit.

Bailie MILLER said he had not got his expenses out of what he received, as he had contributed £30 to the funds of the Ratepayers Association.

Mr. FORSYTH thought the bailie should have waited to see what the generous impulses of the witnesses who went to London against the bill were to do before taunting the late trustees as he had done. It was a most extraordinary think that he and others should be taunted with the paltry sums in question, when, according to Bailie Miller's showing, there was every likelihood of their having to pay every penny of the expense. He would not trust anything to the generosity of foes. The fact was, the matter had been a delusion and a snare. Their lawyers, their clerk, and every gentleman concerned in the late measure, ought to have warned non-professional men like himself of the danger they were incurring in promoting a bill that was not within the limits of the statute, and he thought it was scarcely fair or kind of Bailie Miller to taunt the late trustees, when, if by accident he had himself been a trustee at the time, he would have been promoting, if not the St. Mary's Loch Bill, then some other scheme, and, in the event of its being thrown out, would have found himself in the same position. He declined to vote for either motion, because whatever course was taken, the twenty-five individuals concerned must, for their own protection, lodge a reclaiming note, and, when that was done, he hoped the trust would do its duty to the public by going in for some measure of indemnity which would unite all parties.

Mr. WILSON submitted that the Act of Parliament under which the trust was formed was the work, not of the trust, but of the three Corporations. During the time that Act was in progress, it was admitted by all parties that additional water was required. The water company themselves were going in for more water.

The LORD PROVOST: They offered to spend £200,000.

Mr. WILSON said when the trustees were appointed it was understood that

one of the first things they had to do was to get additional water. He remembered several times in council and trust suggesting the improvement of fittings and checking of waste, but a very general idea prevailed at that time that the water passed down the pipes was not altogether lost in a sanitary point of view. A good many sensible men were of opinion that it would be imprudent to check the outflow of water severely, and that it would be much wiser to go for an additional supply. From that day onward the Works Committee were almost constantly engaged in the consideration of an additional supply. Reports were published, meetings held, representations made to the Corporations from time to time regarding additional supplies, but no person in the three towns ever hinted that it was beyond the power of the trustees to act as the public seemed to expect them to act. On the contrary, they were repeatedly told that penalties would be enforced in five years if additional water was not introduced. He sympathised with the interpretation of the clause adopted by Mr. Archibald, that the penalties appeared to be exigible if additional water was not introduced, and therefore he held that the trustees had good grounds for assuming that there was a claim in law for their proceeding in the matter. Gentlemen like himself, who were thus gradually drawn into the matter, were now told that even although they voted against the St. Mary's Loch scheme, they must now take their share in the whole responsibility with the other trustees, and they, it would appear, were by law to be mulcted, or at least might be mulcted, with those who supported the scheme. Such a position of matters he thought showed that the very idea of attaching personal responsibility to the trustees in the matter was altogether beyond the region of justice or common sense. He was not concerned whether the interdict was held perpetual or not. If it was it would be a caution to all trustees to be more careful in future, and also to corporations who framed bills constituting trusts to see that those bills embraced the purposes intended.

Mr. WORMALD said that the mere lodging of a reclaiming note would not cost more than £20. If, after reclaiming, both parties were willing to let the case stand on the roll without bringing it up for debate, it might be postponed for some time, but in ordinary course it must come up in three or four weeks.

Mr. WILSON thought in that case the wise course would be for the trust to lodge a reclaiming note, and make a representation to the three Corporations on the matter. It was evident that, as trustees, they were tied up, but the Corporations might do something.

Mr. MANSFIELD thought that, seeing the lodging of a reclaiming note would cost no more than £20, which was only 20s. a-piece to the twenty-five gentlemen immediately concerned, it was unreasonable that the present trust should be asked to take the step of reclaiming.

Mr. COWAN was disposed to take part in defending the interdicted trustees until such time as the respective Corporations should have decided what they would do, but no longer.

Mr. MANSFIELD said that if the trust lodged a reclaiming note, they could not withdraw from it if the Corporations told them to go on.

The DEAN of GUILD was not prepared to consent to the lodging of a reclaiming note by the trust, but he cordially concurred in the sympathy which had been expressed for the late trustees, and would be very glad if any method could be shown whereby they could be extricated from their difficulty.

Bailie STEVEN contended that the water company, in all the Acts they applied for, had no more powers than the trust had. That fact should go a long way to show that the trustees did not go so blindly to work, after all. For his own part, he never dreamt of forming an opinion on the subject, but when they had the advice of respectable professional men in going to Parliament, he thought that was quite enough. Along with expressions of sympathy there had been some crowing in the trust as to the recent decision; but he asked if gentlemen ever heard of a decision in the Court of Session being reversed? Let them wait a little, and see how the interdict got through the second division. At any rate, he believed the chances were, that the House of Lords, which upset the St. Mary's Loch Bill, were just as likely to upset Lord Gifford's decision.

Mr. MITCHELL suggested that an appeal should be made to the public to see whether or not those who were anxious to promote the St. Mary's scheme would put their hands in their pockets to relieve the old trustees.

Mr. MACKENZIE said if the present trust were to lodge a reclaiming note, and take up the process at the present stage, it would not be merely a question of £20, but a question of endorsing to a certain extent the policy of their predecessors, and taking the responsibility of fighting it to the end. In his own case that would involve the absurdity of bringing him in as both pursuer and defender.

Provost WOOD remarked that in Portobello the community had been consulted on the subject by public meeting, and that the Council there had from time to time instructed him in all he had done in supporting the St. Mary's Loch scheme.

Mr. METHVEN approved of the motion; and could scarcely believe that those who objected to it really sympathised with the old trustees. He did not believe that a more popular thing could happen in the city at this moment than for the new trustees to go heartily with the old trustees in having this matter cleared up.

In the course of some further discussion,

Mr. ARCHIBALD said if the object of all parties was to get the matter amicably settled, there was only one way to do it, and that was by connecting themselves with the three Corporations, and taking those bodies along with them. If the old trustees were to be driven to protect themselves in the way which had been indicated, and gentlemen were determined to make them personally liable, the battle would be carried to the House of Lords; and even if defeated there, and if the trust and Corporations went for a bill and did not put a clause of indemnity in it, those for whom he spoke would employ counsel, and state their case to Parliament itself.

Mr. WORMALD said the members of the old trust, against whom the interdict was directed, were individually called, and they must individually reclaim. He had no objection to make his amendment read as follows:—"That the trust resolve to take no action in the way of reclaiming against Lord Gifford's interlocutor; but remit the said interlocutor to the three Corporations for their consideration."

On the question being put, the amendment was carried, and the trust adjourned.

MEETING OF THE RATEPAYERS ASSOCIATION.

On Wednesday evening, Dec. 6, a Meeting of those who sympathised with the opposition to the St. Mary's Loch scheme, was held in Queen Street Hall—Councillor COWAN in the chair.

Mr. RICHARD WILSON submitted the report of the committee, which showed that the expenditure in connexion with the opposition amounted to £9062 2s. 4d., and that the subscriptions amounted to £5303 17s. 2d.—leaving a deficiency of £3758 5s. 2d. The report was adopted, and a motion unanimously carried to open a new subscription list in order to raise funds to defray the existing liabilities. The following is a detailed abstract of the accounts of the Ratepayers Association in connection with the opposition to St. Mary's Loch scheme:—*Charge.*—Subscriptions to opposition in House of Commons, £2034 7s. 10d.; subscriptions to opposition in the House of Lords, £3177 8s. 4d.—£5211 17s. 2d. Miscellaneous receipt, £9 10s. Outstanding subscriptions to opposition in House of Commons, £33; outstanding subscriptions to opposition in the House of Lords, £49 11s.—£82 11s.—Sum of charge, £5303 17s. 2d. *Discharge.*—Parliamentary expenses—Mr. William Robertson, parliamentary solicitor:—First, for Commons, £1106 18s. 3d.—Whereof, for counsels' fees, £698 5s.; for outlays, £230 5s. 7d; business charges, £178 7s. 8d. Secondly, for Lords, £1094 18s. 11d.—Whereof, for counsels' fees, £648 7s. 6d.; for outlays, £311 14s. 1d.; business charges, £134 17s 4d—amount, £2201 17s. 2d. Messrs. Gibson-Craig, Dalziel, and Brodies:—First, for Commons, £460 7s. 9d.—Whereof, business charges, £324 11s. 6d.; outlay, £135 16s. 3d. Secondly, for Lords, £443 8s. 10d.—Whereof, business charges, £322 1s.; outlay, £121 7s. 10d.—amount, £903 16s 7d. Mr. Robert Johnston, secretary, £535 8s. 10d.—Whereof, business charges, £354 4s. 9d.; outlay, £181 4s. 1d. Messrs. Alexander and Littlewood, £69 17s; Mr. Alexander, Selkirk, £23 3s. 3d; Mr. Murdoch Paterson, £2 12s. 6d; Mr. Alexander, Selkirk, proportion of accounts for soundings, £12 2s. 6d.; Messrs. Simpson and Taylor, £10 10s.; Messrs. W. and A. K. Johnston, £5 13s. 5d.; Messrs. Stewart, Rule, and Burns, £1 16s.; Messrs. Macgregor, Stevenson, and Flemings, £5 15s. 1d.—sum, £3772 12s. 4d. Expense of Petitions.—To House of Commons, £208 6s. 8d.; to House of Lords, £201 19s. 1d.—sum, £410 5s. 9d. Expense of Witnesses.—*Engineering Witnesses.*—Mr. J. R. Forman, C.E., Glasgow, £812 15s. 10d.; Mr. Thos. Hawksley, C.E., London, £273; Mr. Thomas Stevenson, C.E., Edinburgh, £250; Mr. James Leslie, C.E., Edinburgh, £140 10s.; Mr. G. W. Hemans, C.E., London, £210; Mr. John Ayres, C.E., Norwich, £109 8s.; Mr. Allan D. Stewart, C.E., Edinburgh, £52 10s.; Mr. W. Pole, F.R.S., London, £63; Mr. John Masterton, C.E., Edinburgh, £52 10s. 11d.; Mr. Alexander Ramsay, Edinburgh, £247 18s.; Mr. J. A. King, contractor, Stewarton, £45; Mr. A. W. Morant, C.E., Norwich, £21—amount, £2277 12s. 9d. *Scientific Witnesses.*—Mr. James Glaisher, London, £154 3s.; Dr. Letheby, London, £133 7s.; Professor Geikie, Edinburgh, £118; Dr. Voelcker, London, £63; Dr. R. Bell, Glasgow, £25; Dr. W. Wallace, Glasgow, £25; Dr. C. Bell, Edinburgh, £12; Dr. C. Wilson, Edinburgh, £9; Dr. Dewar, Edinburgh, £56 7s.; Dr. J. Hogg, microscopist, £30 9s.—amount £626 6s. Citizen and other witnesses.—House of Commons—Bailie Miller, Edinburgh, £33 12s.; Councillor Wormald, Edinburgh, £43 4s.; Councillor Muirhead, Edinburgh, £12; Mr. Richard Wilson, C.A., Edinburgh, £58 8s.; Mr. B. F. Dun, Edinburgh, £5; Mr. S. Bathgate, Selkirk, £24 3s.; Henderland, Shepherd, £6; Morley's Hotel, for committee room, and unpaid witnesses charges, £33 18s. 8d.—amount, £216 5s. 8d. House of Lords—Bailie Miller, Edinburgh, £36 18s.; Councillor Wormald, Edinburgh, £45 6d.; Convener Robertson, Edinburgh, £5; Mr. Richard Wilson, C.A., Edinburgh, £43 14s.; Mr. C. M. Barstow, Edinburgh, £10; Councillor Muirhead, Edinburgh, £10; Mr. Thos. Field, Edinburgh, £10; Mr. Wm. Macdonald, Edinburgh, £33 16s.; Mr John Ferguson, Edinburgh, £18; Mr. M'Whinnie, Edinburgh, £15 18s.; Mr. William Mitchell, Meggethead, £8 8s.; Mr. William Richardson, £8 8s—amount, £245 8s. Sum, £3365 12s. 5d. Expense of dinner at Richmond, on occasion of bill being thrown out by Lords, £43 18s. 11d.; expense of collecting subscriptions, £423 17s. 6d.; advertising, £253 2s. 10d.; postages, £198 2s. 7d.; printing, £277 11s. 7d.; miscellaneous expenses, £316 18s. 5d. Sum of the discharge, £9062 2s. 4d. Amount, as per charge, £5303 17s. 2d.; amount, as per discharge, £9062 2s 4d. Showing a deficit of £3758 5s 2d.

DR. WHITMORE'S REPORT ON THE QUALITY OF THE WATER SUPPLIED IN ST. MARYLEBONE, IN NOVEMBER, 1871:—

NOVEMBER, 1871.	Total Solid Matter in degrees or grains per Imperial gallon.		* Loss by Incineration of Solid Matter in previous column.		Ammonia.
	Nov., 1870.	Nov., 1871.	Nov., 1870.	Nov., 1871.	
Distilled Water . . .	0°	0°	0°	0°	0°
West Middlesex water .	18·14	17·96	0·78	0·72	—
Grand Junction water. .	18·18	17·88	0·76	0·78	—

* The loss by incineration represents the amount of organic and other volatile matters contained in an Imperial gallon (70,000 grains) of water.

DR. WHITMORE'S REPORT ON THE QUALITY OF THE GAS SUPPLIED IN ST. MARYLEBONE, IN NOVEMBER, 1871:—

NOVEMBER, 1871.	Illuminating Power in Sperm Candles.			Mean Pressure in Tenths of an Inch.		Mean Quantity of Sulphur in 100 Cub. Ft.	Mean Quantity of Ammonia in 100 Cub. Ft.	Sulphuretted Hydrogen.
	*Mean of 25 Obser.	Highest.	Lowest.	Highest.	Lowest.	Grains.	Grains.	
Imperial Company's gas . . .	16·53	16·66	16·01	29·35	10·38	32·11	1·00	None.
Chartered Company's common gas	16·64	17·01	16·32	38·08	18·67	30·62	0·83	None.
Chartered Company's cannel gas	23·06	23·69	22·60	30·47	17·88	26·04	1·00	None.

Mean of daily readings of barometer . . . 29·83
" " " thermometer . . . 50·87

* Each observation consists of 10 readings of the photometer, at intervals of one minute

The mean illuminating power of the Imperial Company's gas was equal to the light of 16½ candles, and ranged between 16·66 and 16·01 candles. The mean amount of sulphur contained in 100 cubic feet of this gas was 32·11 grains, and of ammonia 1 grain. The mean light of the Chartered common gas was equal to rather more than 16½ candles, and ranged between 16·32 and 17·01 candles. The mean quantity of sulphur was 30·62 grains, and of ammonia 0·83 grain. The mean light of the cannel gas was equal to 23 candles, and ranged between 22·60 and 23·69 candles. The mean quantity of sulphur was 26·04 grains, and of ammonia 1 grain. The pressure of all the gases was satisfactory, and on no occasion was sulphuretted hydrogen detected in either of them. The above results were obtained from the gas manufactured by the Imperial Company, at their Fulham works, and from the Chartered Company's gas manufactured at their works, Horseferry Road, Westminster.

APPOINTMENT OF GAS EXAMINER AT BECKTON.—At the meeting of the Court of Common Council of the City of London, held on Thursday, Dec. 11, the Gas Committee made a report, in which they recommended that Mr. Charles William Young be appointed gas examiner at the Beckton station, at a salary of £200 a year, one half of which is to be paid by the Metropolitan Board of Works; and that Mr. Charles Heisch should receive £700 for the year from the 29th of September, 1871, to the 29th of September, 1872, being the same amount as last year, he paying the salaries of the several gas examiners, including the portion of the salary of the gas examiner at Beckton not paid by the Metropolitan Board of Works; and also recommendiug that, in accordance with the provisions of the City of London Gas Act, 1868, Mr. Heisch be appointed a gas examiner for the new station at Beckton. On the motion of Mr. E. Dresser Rogers, the report was agreed to *nem. dis.*

SEWAGE AS A FERTILIZER OF LAND, AND LAND AS A PURIFIER OF SEWAGE.

By J. Bailey Denton, C.E., F.G.S.,

Honorary Member of the Royal Agricultural Societies of Norway, Sweden, and Hanover.

[Read before the Society of Arts, London, on Wednesday, Dec. 6.]

Having recently appeared as a correspondent of *The Times* on the sewage question, it may very reasonably be assumed that I have exhausted the subject, as far as I am personally able to do so; but the fact is, that having in the letters to which I refer explained the advances made by the chemist and the engineer, and shown that there has prevailed, up to this time, a disregard of the properties of different soils for the retention of the fertilizing ingredients of sewage, and the purification of the water with which the sewage is mixed, I left the subject where I considered the agriculturist should take it up. Hence my appearance before our society at a season when many of its members connected with agriculture will be in London.

I will promise to condense the remarks I have to make as much as possible, in order that there may be sufficient time for the expression of opinions which I shall do my best to challenge.

Though large figures have been put forth, by sundry writers and speakers, of the immense loss this country suffers by casting the sewage of its towns into the rivers, and everybody acknowledges, not only that such waste ought not to continue, but that our rivers should be restored to their original purity, we have not yet brought to practical test the value of sewage to the farmer and the market gardener. Chemists have done their best to rouse public attention to the loss we suffer, and it now remains with the country to adopt those measures which will best conduce to its recovery.

Large as the intrinsic value of the fertilizing matter has been shown to be by the chemist, the value of the water in which it is contained has been excluded from his consideration, though farmers and gardeners alike are prepared, after the experience of the recent years of drought, to put a high value on water for its own sake, irrespective of the fertilizing elements it contains after sewage has been mixed with it, for they know how serviceable is timely moisture to the germination of seed, and for reviving and sustaining plant growth, independently of its special power of conducting to the roots of plants, in the most acceptable way, those fertilizing ingredients which the chemist has valued so highly.

Hitherto, the benefit to be gained by a command of water has been more than counterbalanced by the disadvantages of excess, and the obligation of disposing of the liquid sewage at all times and under all conditions. In referring to water, therefore, I do so only to remark that, large as the theoretical value of the manurial properties of sewage has been declared to be, it may yet bear an increase when the practical mind of the agriculturist is brought to bear on its utilization, and the disadvantages under which a new branch of industry always suffers are overcome.

A High Standard of Purity of Water essential.—But so slow and so naturally sceptical, in respect of new appliances, is the agricultural mind, that we must not wait for the recognition of the cultivator as the only thing necessary for the development of the value of sewage. We must rather trust to the obligation which will before long be imposed on all sewer authorities, so to treat the liquid refuse of towns that the effluent liquid shall conform to a recognized standard of purity; for it will only be by the most stringent enforcement of the law in this respect that all the manurial properties of sewage will be rendered available for reproduction.

Taking this view, I think it is much to be regretted that the Conservators of the Thames have, without pledging themselves to any positive decision, recognized a standard of purity* in some degree inferior to that suggested by the present Rivers Pollution Commissioners in their first report, and that they have done so in the face of a statement by the commissioners, that they made the suggestion with the "belief that, as science progresses, improved methods of purifying polluted liquids will be discovered, and that eventually standards of purity considerably higher than those recorded may, if necessary, be enforced." Without presuming to give any opinion upon the details of the standard suggested by the commissioners, which I know is regarded by some chemists as objectionable, I am content to record the fact that their anticipation has already been in a measure realized. This is not mere assertion; it has been conclusively shown that when natural soil is so prepared, by properly designed deep drainage and deep surface cultivation, that the whole of the sewage distributed upon its surface is absorbed and percolates *evenly* through the soil, the effluent liquid passes into the arterial outfalls from the under-drains purified to a very high degree, and unobjectionable in every respect. Such, in point of fact, appears to be the purification effected by oxidation, resulting from the aëration of drainage and the intermittent use of soil for filtration, that it is not at all a too sanguine view to take, that, with increased experience, we may arrive at a power of restoring water, with which sewage has been mixed, to its original potable condition.

For the convenience of those interested in the matter, I here give the standard suggested by the Rivers Pollution Commissioners, and will add that which has been circulated by the Thames Conservators. The commissioners suggest that the following liquids be deemed polluting, and inadmissible into any stream:—

(*a.*) Any liquid containing in suspension more than three parts by weight of dry mineral matter, or one part by weight of dry organic matter in 100,000 parts by weight of the liquid.

(*b.*) Any liquid containing in solution more than 2 parts by weight of organic carbon, or ·3 parts by weight of organic nitrogen in 100,000 parts by weight.

(*c.*) Any liquid which shall exhibit by daylight a distinct colour when a stratum of it one inch deep is placed in a white porcelain or earthenware vessel.

(*d.*) Any liquid which contains in solution, in 100,000 parts by weight, more than two parts by weight of any metal except calcium, magnesium, potassium, and sodium.

(*e.*) Any liquid which, in 100,000 parts by weight, contains, whether in solution or suspension, in chemical combination or otherwise, more than ·05 part by weight of metallic arsenic.

(*f.*) Any liquid which, after acidification with sulphuric acid, contains, in 100,000 parts by weight, more than one part by weight of free chlorine.

(*g.*) Any liquid which contains, in 100,000 parts by weight, more than one part by weight of sulphur, in the condition either of sulphuretted hydrogen or of a soluble sulphuret.

(*h.*) Any liquid possessing an acidity greater than that which is produced by adding two parts by weight of real muriatic acid to 1000 parts by weight of distilled water.

(*i.*) Any liquid possessing an alkalinity greater than that produced by adding one part by weight of dry caustic soda to 1000 parts by weight of distilled water.

The following standard of purity for defecated water is that recommended by the chemists consulted by the Thames Conservators, and it will be seen that it is, as I have stated, less stringent than that suggested by the Rivers Pollution Commissioners. They say: "1. It should be free from an offensive odour. 2. It should be free from suspended matters, or, in other words, be perfectly clear. 3. It should not be alkaline to turmeric paper, nor acid to litmus paper. 4. It should not contain per gallon more than 60 grains of solid matter dried at 260° Fahr. 5. It should not contain more than three-quarters of a grain of organic and ammoniacal nitrogen per gallon. 6. It should not contain more than two grains of organic carbon per gallon. 7. It should contain not less than one cubic inch of free oxygen in a gallon." It should be observed, however, that one of the eminent chemists who signed this recommended standard, Dr. Frankland, being himself a member of the Rivers Pollution Commission, added these words: "The conditions under which fluid which has been contaminated with sewage may be admitted into the Thames, as prescribed in the foregoing report, will, I have every reason to believe, preserve the river from being offensive to the inhabitants upon its banks; but, whilst thus far agreeing with my colleagues, I wish it to be distinctly understood that, in my opinion, such fluid can only be safely admissible into the Thames on condition that the water is not afterwards used for domestic purposes."

The conservators of the River Lee, in the absence of any standard recognized by the Government, have hitherto abstained from issuing one of their own, and the consumers of water in the metropolis are to be congratulated that they have done so, for the publication, limited though it has been, of the lower standard recommended to the Thames Conservators has already had the effect of encouraging results inferior to those which are to be desired. The Lee Board reserves to itself judgment until the towns discharging into the river have completed their purifying works, for which they have extended the time, at the expiration of which, it is to be hoped that some positive action towards the establishment of standards to fit different circumstances will have been taken by the central local government authority. Until such is the case, we shall probably see, both on the Thames and on the Lea, the sewer authorities of towns disregarding, naturally enough, the higher standard of the Rivers Pollution Commissioners, and in spite of the protest of Dr. Frankland, and the general sense of the country, the inhabitants of London may be compelled to drink polluted water, and, as a natural consequence, the contamination of our streams will continue throughout the length and breadth of the land.

This point, however, is not that upon which I desire to dwell. It is of sewage as a fertilizer of land that I must speak, though it is right to repeat emphatically, what must be manifest to every practical mind, that so long as the pollution of rivers is permitted in a modified degree, by the recognition of any standard of inferior character, the fertilizing ingredients of sewage will not be wholly recovered from the water with which they are mixed.

Sewage as a Fertilizer of Land.

To show what is the intrinsic value of the fertilizing ingredients of sewage, I will, in the shortest manner possible, state the conclusion to which Messrs. Lawes and Gilbert came in 1866, in their very complete and careful paper on the "Composition, Value, and Utilization of Town Sewage," read before the Chemical Society, and which, I believe, expresses pretty accurately views in which the majority of those who are competent to deal with the subject concur. Having adopted the case of Rugby as a fair example of water-closet towns, the discharged sewage being equal to 36 gallons per diem, or 60 tons per head per annum, including surface and subsoil waters, they stated that, "looking to the average results of 93 analyses," they found "that the sewage contained about 87½ grains per gallon of total solid matter, of which about two-thirds was inorganic, and one-third organic. About half the total solid matter was in suspension, and half in solution; of the half in suspension, about four-sevenths was inorganic, and three-sevenths organic, and of the half in solution about four-fifths was inorganic, and one-fifth organic. Lastly, of the nitrogen, reckoned as ammonia, about one-fourth was in suspension, and three-fourths in solution. The mean of the 93 analyses showed about 6½ grains of ammonia per gallon, indicating a value of 1⅝d. for the total constituents in one ton of sewage." These figures, multiplied by the 60 tons of sewage per head per annum, resulted in showing "that 12½ lbs. of ammonia were contributed annually for each average individual of the mixed population of both sexes, and all ages." This quantity of ammonia, at 8d. per lb., gives 8s. 4d., or 100 pence, as the value of sewage per head from water-closet towns. Various other estimates have been made of the sewage of water-closet towns. Dr. Letheby took samples, at noon and at midnight, from a number of sewers in the metropolis, and arrived at the conclusion that 7·24 grains represented the mean quantity of ammonia per gallon. Messrs. Hofmann and Witt, having treated one particular sewer, considered that 8·21 grains represented the quantity of ammonia. These two quantities would, if taken at the same price of ammonia, result in larger figures than those of Messrs. Lawes and Gilbert.

There have been several estimates made of the value of sewage, by modes of computation differing from that based on the whole sewage of towns as discharged by the sewers, and as they will assist us in considering what proportion of the excrementitious matter of the closet may be kept out of the sewers, with benefit to agriculture and profit to the ratepayers of sewered districts, I will shortly refer to them. Messrs. Hofmann and Witt, and Dr. Thudichum, having ascertained the amount of urine and fæces voided by individual persons, taking an average of both sexes of all ages, valued the urine at 7s. 3d. and the fæcal matter at 1s. 2¾d., which together, it will be observed, is very nearly the same amount as that put upon the whole sewage by Messrs. Lawes and Gilbert.

There is an anomaly in these estimates which has to be reconciled, inasmuch as it appears that the excrements of human beings alone, exclusive of the refuse from slaughter-houses, stables, cow-houses, and dog kennels, as well as that discharged from the kitchen, with its refuse of vegetable and animal food, is more valuable than the whole liquid refuge of a town, when the contents of the closet are discharged into the sewers as well as all other refuse. And the anomoly becomes more difficult of reconciliation when we have to consider a statement by the Rivers Pollution Commissioners to the effect that, comparing water-closet towns in which the whole of the sewage issues from the sewers, with "midden" towns, in which a considerable portion of the human excreta is detained and disposed of separately, there is a remarkable similarity of composition between the two.

I will not detain you by any endeavour to reconcile these analyses and statements, but will only remark that, assuming them to be correct, an important consequence follows—viz., that, in an agricultural view, it is desirable to treat the excremental contents of privies separately, for if no appreciable loss of fertilizing matter is found to exist in liquid sewage when separated from that of the privies, it is manifest that a decided national gain is obtained by the maintenance of the two systems, inasmuch as the dry, portable manure obtained from the privy contents will be so much fertilizing matter available for distant lands, in addition to the liquid sewage, which may be utilized by irrigation near at home.

But the realization of the fertilizing value of sewage in the liquid state depends necessarily upon two precedent conditions, the first being the obligation which should be imposed on all towns by the central local government authority, to *perfectly* cleanse their sewage; and the next, the preparation by the sewer

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* The following notes to and from Captain Burstal, the secretary of the Thames Conservancy, will explain the position of this particular question at the present moment:—

"*Stevenage, Nov.* 24, 1871.

"Dear Sir,—I presume I am right in assuming that the standard of purification recommended by Drs. Frankland and Letheby, and Professor Odling, is that which your Board of Conservators recognize as sufficient to regulate the influx of liquid sewage from towns on the banks of the Thames. When answering this question, would you kindly tell me whether the standard applies equally to the towns above Hampton as below.

"I am, dear sir, yours faithfully,
(Signed) "J. Bailey Denton.

"Captain Burstal, Thames Conservancy."

"*Thames Conservancy Offices*, 41, *Trinity Square, Tower Hill, E.C., Dec.* 1, 1871.

"Dear Sir,—In reply to your letter of the 24th ult., I beg to inform you that the conservators do not recognize any standard of purity for effluent water from sewage from places on the banks of the river above Teddington.

"I am, dear sir, yours faithfully,
"E. Burstal, Secretary.

"J. Bailey Denton, Esq., Orchard Court, Stevenage, Herts."

authorities of the land designed to receive the sewage, in such a way that the whole may be *fully* utilized. With these two duties performed, and not otherwise, there is a fair prospect of at least a penny a ton being realized for liquid sewage of average strength, half of which (as I have stated on former occasions) should go into the pockets of the ratepayers, in repayment for the necessary works, while the other half will be due to the cultivator as a return for his industry and the employment of his capital.

Excluding from consideration the value of the water which I contend will become a great item in the profitable treatment of sewage, the subject before us may be classified under three heads, viz.—1. Where the whole of the sewage is treated by chemical process at the mouth of the sewer. 2. Where it is transported from the sewer mouth to land for distribution there. 3. Where a part of the excrementitious refuse is treated separately from the remainder. The question which addresses itself, therefore, to the authorities of all sewered districts is, which of these methods of treatment will best enable them to effect the twofold object of purifying the sewage and utilizing it to the greatest advantage; while the question which the agriculturist has to consider is, which method will place at his command, at a fair price and in the most productive shape, the fertilizing matter which the sewer authorities must extract, in order to cleanse the sewage perfectly.

I.—*Chemical Treatment of the whole of the Sewage at the Mouth of the Sewer.*

Leaving out of consideration all treatments which aim only at the purification of the sewage, without turning its fertilizing properties to use, as irrelevant to my subject, I will confine my observations to those chemical processes by which both these objects are said to be obtained. Many processes have been before the public aiming at this end, and several have been patented, and afterwards brought forward by public companies.

The Native Guano Company, better known as the company possessing the patent of the "A. B. C. Sewage Process," now stands very prominently before the public, in consequence of its shares being at a high premium, and because arrangements have been made by the authorities of Hastings, Leeds, Bolton, and Southampton, as well as by the Metropolitan Board of Works, to test by comprehensive experiments the value of the process, although it has been superseded at Leamington by irrigation. The initials "A. B. C." indicate the principal ingredients of the chemical mixture—viz., alum, blood, and clay—by which it is stated the polluting and fertilizing parts of sewage may be precipitated, and made available as a manure. I do not propose to enter into any details of the process itself, but will merely state that the specification of the patent sets forth that 4 lbs. of mixture are required for every 1000 gallons of sewage treated; and that Mr. Rawson, the general manager of the company, tells me that 100,000 gallons of sewage of average strength—diluted to the extent of 30 gallons a day—will produce from 20 to 25 cwt. of dry manure; from which statement we see that, if the specified proportion of mixture to sewage were adhered to, 400 lbs. of mixture will be required for the production of a ton of saleable manure. The company declare that deodorization takes place immediately on the first addition of the A. B. C. mixture, and in proof of the purification effected give the following analyses:—

Comparative Analysis in Grains per Gallon.

	Average of 50 Samples. Sewage.	Average of 50 Samples. Effluent Liquid.
Organic matter	17·2	1·4
Mineral matter	37·4	16·9
Total	54·6	18·3

I will now offer such evidence as I can of what the Native Guano Company can do towards the purification of sewage and the extraction of its fertilizing parts, premising that Mr. Rawson has most courteously afforded me every facility for ascertaining the results arrived at by farmers and gardeners who have used the manure sold by the company.

The Rivers Pollution Commissioners having made very careful experiments at Leicester and Leamington, state in their second report (dated July 4, 1870) that the process removes a very small proportion of the soluble polluting matter from sewage, and that "the manure obtained has a very low market value, and cannot repay the cost of manufacture." Their analysis of the effluent liquid, made of samples taken on the 10th of May, 1870, showed the following result, although the quantity of mixture used was increased very largely beyond the proportion prescribed in the specification (4 lbs. to 1000 gallons of sewage).

Analysis expressed in Parts per 100,000.

Total solid matter in solution	123·05
Organic carbon	4·727
Organic nitrogen	1·892
Ammonia	8·060

These figures are very much in excess of those I have just quoted as given by the company; though if the latter were compared with either the standard of purity suggested by the Rivers Pollution Commissioners, or that recommended to the Thames Conservators, it will be seen that the condition indicated is not such as to render the effluent liquid admissible into running streams. How Leeds and the other towns mentioned will ultimately conform to a national standard of purity remains to be seen. As to the manure made by the Native Guano Company, the commissioners said that "the so-called A. B. C. manure is little more than the original suspended solid matter of raw sewage, *plus* the insoluble materials added in the A. B. C. mixture, 19-20ths of this being merely clay."

The chemists employed by the Metropolitan Board of Works state, through Dr. Odling (June 24, 1870), when speaking of this process, that after examination they found "there was a great deal of putrescible matter in the effluent liquid; and in comparing this mode of precipitation with others, it did not seem that its alleged superiority had any foundation."

Dr. Voelcker, in the *Journal of the Royal Agricultural Society* (vol. vi., S.S., part ii.), having analyzed five different samples of the manure sold as native guano, stated the result to be as follows:—

No. 1 sample was worth	£0	18	6	per ton
2 " "	1	13	6	"
3 " "	0	14	0	"
4 " "	0	18	6	"
5 " "	0	14	6	"

basing his value on a comparison of the manure with phosphate of lime at £10 a ton, and ammonia at £60 a ton.

Still, in the face of these adverse opinions, expressed by the highest chemical authorities of the country, the Native Guano Company is advertising its dried manure at £3 10s. per ton, and are finding customers at that price. Some farmers and gardeners with whom I have corresponded speak very favourably of it, and declare their intention of buying more, while others say they have not been able to distinguish any advantage from the use of it, and one farmer goes so far as to threaten an action for injury done by its use. On the whole, the replies I have received do not lead me to the conclusion that the sale of the manure will be very great after public curiosity is satisfied, for it is more than probable that the sales that have taken place have resulted from the desire to give the manure a trial, under a false notion that because Peruvian guano is advertised at £13 5s. a ton, and phospho-guano at £11 10s. a ton, "native guano" must be cheap at £3 10s. a ton. If, however, the sale should continue, the failure of the process to effect purification up to any recognized standard must act as a veto to its adoption, except in those cases where the authorities of towns may be content with clarified in the place of purified sewage.

The Phosphate Sewage Company, founded on a patent taken out by Dr. David Forbes, of which dissolved phosphate of alumina for precipitation is the base, aims at doing all that the A.B.C. process professes to do, with the additional recommendation of being associated with irrigation where circumstances favour the adoption of the two processes, which, seeing that the separation of the coarser solid parts of sewage from the liquid is a desideratum in irrigation, may frequently be the case. The company state that, "if phosphate of alumina alone is used, the sewage is defæcated, the solid matter is precipitated, and the water is left still maintaining all its nitrogenous and valuable properties, *plus* any excess of phosphoric acid which has been added, and, therefore, highly useful for the irrigation of cereals and other crops, and at the same time perfectly inoffensive. This process will be adopted where it is deemed desirable to use the water as a fertilizing agent for irrigation purposes, since it possesses advantages, both in an agricultural and sanitary point of view, above any system of sewage irrigation hitherto used. In the case of towns to which sewage irrigation is inapplicable or disadvantageous, and which are desirous of rendering their sewage water sufficiently clear and pure to return into a river or stream, this object can be effected by adding a small quantity of lime to the sewage after treatment by the former process." This company, in fact, declares itself able not only to purify sewage to a degree to render it admissible into rivers, and to manufacture a manure out of the precipitated matter, but to render the effluent liquid more suitable for irrigation than the sewage itself. These statements are made on the authority of Dr. Voelcker. The analysis of the effluent liquid discharged during certain trials at Tottenham gives the following result in grains per imperial gallon:—

Organic matter in solution	5·74	
" " suspension	none	
Total organic matter		5·74
Mineral matter in solution	57·71	
" " suspension	none	
		57·71
Total solid matter (organic and mineral)		63·45
Organic nitrogen in solution	·47	
" " suspension	none	
Total organic nitrogen		·47
Equal to ammonia	·57	
Saline ammonia	3·32	
Total nitrogen calculated as ammonia		3·89

Compared with the suggested standard of the Rivers Pollution Commissioners, this analysis does not show the requisite amount of purity.

I have endeavoured, from information supplied me by Mr. Lonsdale, the secretary of the company, to obtain some tangible proofs of the value of the manure manufactured by the company, but the number of instances are so few in which actual trial has been made on a scale affording any practical test, that I confess myself unable to draw any deductions whatever; and when stating there can be no doubt that a valuable manure may be made by mixing with the fertilizing parts of sewage the phosphate of alumina, it must be borne in mind that there exists no proof that the manufacture will be attended with profit. It must also be remembered that the operations of the company depend upon the supply of phosphate of alumina, which, like all other foreign importations obtained from a distance, must be liable to vicissitudes bearing upon the fortunes of the company, and on the interests of those towns and districts having dealings with it. Associated with irrigation as a never-failing resource when the phosphate may not be forthcoming, or when the manure may not command a sale, such objections would not exist.

With certain seaboard towns, where the effluent sewage need only be clarified to be free from objection, this company, like the Native Guano Company, may probably do a large amount of work, if it should turn out that a saleable manure may be profitably made; though, with the experience we are now having of the power of a small quantity of natural soil to cleanse a large body of sewage by intermittent filtration, and to grow crops at the same time, so that the scavenging powers of vegetation may render their aid in purification (as I shall presently show may be the case), it will probably be found more economical to have recourse to that process which is attended with no nuisance whatever, than to establish manure manufactories with all the attendant risks.

Not having any information to offer with regard to the Peat and Engineering Company, nor of any other chemical or chemico-mechanical processes which deal with the sewage at the sewer mouth, I have nothing further to add about that class of treatment. I will merely repeat that it is daily becoming more generally acknowledged and acted upon, that "the present resources of chemistry appear to hold out no hope that the foul matters dissolved in sewage will be precipitated and got rid of by the application of chemicals to the offensive liquid," and that, therefore, we must look to the direct application of sewage to land wherever it can be obtained for the purpose, as the most desirable means of recovering from water those "ingredients held by it in solution and suspension which do not belong to it, and which render it objectionable and unfit for ordinary and domestic purposes."

II.—*Transport of the whole Sewage in its Liquid State from the Sewer Mouth direct to the Land, for Distribution on the Surface.*

So much has been written and said recently on the practice of sewage irrigation, that I should be disposed to say very little on the subject, had not the special properties of the soil itself for appropriating the fertilizing matter of sewage, and for cleansing the sewage itself, been, to a very great extent, omitted from consideration, and had not Boards of Health—the worst farmers in the world—been the principal cultivators up to the present time. Believing that, with a recognition that the soil will perform the functions accredited to vegetation as, or more, effectually than vegetation itself, and that the two in combination will obtain the best results, both as a means of profit and as a sanitary agency, I regard all calculations that have hitherto been made as to the number of persons contributing sewage per acre, and the rules that have been laid down on that score, as worth very little as a guide for the future, when the principle shall be fully recognized that the surface of land must be rendered so absorbent that no sewage shall pass off into the river courses.

In the application of sewage to land, the local features will, in future, decide the question whether the purification of the sewage and its profitable use should be treated as objects of equal importance, or whether the purification should be the paramount object, and utilization a subsidiary one. If sufficient land for wide irrigation is not to be obtained, or if obtained only at a price that shall place the application of the sewage, by way of irrigation, beyond the possibility of profit, it is manifest that we must call to our aid the cleansing powers of an aërated soil, and regard the land more in the character of a filter than we have hitherto been disposed to do; and by adopting intermittent application, the effect of which has been so admirably explained by the Rivers Pollution Commissioners, realize all the advantages to be gained from it.

The two processes of irrigation and filtration are already viewed so differently from the way in which they were regarded in their first introduction, that it is necessary to state how we stand with regard to them at the present moment. It will be remembered that, up to very recently, an opinion prevailed with respect to irrigation that "the object of getting sewage on to the land was, not to let it percolate into the ground, but to keep it on the surface," and that subsoil drainage would not do for sewage farms, because the sewage passed too rapidly to the roots of vegetation, and descended downwards.

Under-drainage as Essential to Irrigation as to Filtration.—Some members of

this society may remember, on the occasion of my reading a paper on "The Water Supply of the Metropolis, in Relation to the Thames and its Tributaries," my friend Mr. Rawlinson, who has ever been the consistent and able advocate of the application of sewage to land, stated in this room, without giving any opinion himself, that some persons practically "acquainted with sewage irrigation would prefer, from their experience, to irrigate clay lands without under-drainage, if Italian rye-grass, which was the most profitable crop, were to be sown;" and the little difference of effect that was to be noticed at Norwood, where the land was clay, and the manager had actually plugged the drains in order to keep the land in a state of supersaturation, when compared with Croydon, where the land is free and is naturally drained, has often been quoted as a reason why sewage irrigated land should not be drained. I will not stop to condemn this view, which is repugnant alike to the sanitarian and the agriculturist, as it may be already observed that, with very few exceptions indeed, operators now disclaim the opinion that under-drainage is unnecessary. So decided has the appreciation of drainage become with the majority of sewage irrigators, that in the eagerness to secure rapid absorption, sewage farms have become filter-beds of too rapid action, and by the adoption of inappropriate drains, the purifying powers of the soil have been jeopardized. Short as the interval has been since intermittent downward filtration was first suggested by the Rivers Pollution Commissioners, that process has, like irrigation, undergone a change. The Rivers Pollution Commissioners stated — evidently under the impression that sewage would only be applied to a barren or fallow surface—"that with a properly constituted soil, well and deeply drained, nothing more would be necessary than to level the surface and divide it into four equal plots, each of which in succession would then receive the sewage for six hours. In this way the sewage of a water-closet town of 10,000 inhabitants could, at a very moderate estimate, be cleansed upon five acres of land, if the latter were well drained to a depth of six feet." They then go on to state that, nevertheless, there are three formidable objections to the general adoption of the process:—(1) "It is entirely unremunerative." (2) "The whole of the manurial ingredients of the sewage would be absolutely wasted." And (3) "The collection of solid fæcal matter upon the surface of the soil, with no vegetation to make use of them, would probably give rise to a formidable nuisance, especially in hot weather." The change to which I have referred has arisen on the proof which I have had the satisfaction myself of affording, that vegetation may be grown upon the surface of filtering areas, even when receiving sewage equal to the discharged refuge of 3000 persons to each acre, thus adding, in the most apposite manner, to the cleansing powers of the soil the scavengering properties of vegetation. When speaking presently of land as a purifier of sewage, I shall give the particulars of the instance referred to, which, though the first and only case in which intermittent filtration has been tried and modified by the growth of crops, cannot fail to prove that the objections anticipated by the Rivers Pollution Commissioners may be avoided.

Technical Description of Irrigation and Filtration.—With the general admission that under-drainage is essential wherever sewage is applied to the surface of land, it must now be generally understood that irrigation means the distribution of sewage over as many acres as it will wet without supersaturation, having in view a maximum growth of vegetation from the amount of sewage applied, and that any departure from this, resulting in excessive application, is a waste of fertilizing matter. I think it may also be taken as proved that filtration through soil should not necessarily mean its application to a fallow or barren surface (as contemplated by the commissioners), but the concentration of the sewage, intermittently, on as few acres of land as will absorb and cleanse it, without excluding the production of vegetation at the same time.

Irrigation.—Having given the interpretation of irrigation as the application of sewage to as many acres as it will wet without supersaturation, I should point out that, owing to the absence of a proper apportionment of the sewage at command to a certain quantity of land, considerable waste has resulted in most instances of sewage farming. The Italian irrigators reckon that they lose half their water when carrying the other half forward for use; and having the advantage of enormous quantities of water to deal with, and a power of regaining that which was absorbed by the soil, by tapping it at a lower level, they are indifferent to loss; but in England, where we reckon the value of sewage by the ton, and have taken its intrinsic value at 1d. per ton, we cannot be content to follow such an example. We must, in fact, in this country reject any mode of distributing sewage which does not aim at the utmost economy, and which I may here state would not be attained, in my opinion, if the average quantity of sewage applied to each acre per annum exceeded 2000 tons, which represents the sewage (proper) of 62 persons, with a water supply of 20 gallons per head.

Land may be too Porous.—To judge of the waste resulting from the present mode of applying sewage to the surface of land, we have only to look to the reports of the proceedings at the Lodge Farm, near Barking, published by Mr. Morgan, to whom the public are greatly indebted for the explicit way in which he has given the quantity of sewage applied and of vegetation grown, and we shall see that an average quantity of 4435 tons of sewage per acre was applied during the year ending Aug. 31, 1870, while the quantity used up to the 31st of August last was 3808 tons per acre. If we put ½d. a ton—which I have said sewer authorities ought to receive for their sewage—on each of these quantities, we find that the payment in the first year would have been £9 4s. 9d., and in the last £7 18s. 8d. Turning again to Mr. Morgan's report, it will be seen that as much as 21,488 tons of sewage have been applied per acre in one field of Italian rye-grass. This at ½d. a ton would amount to £44 15s. 4d. This is the extreme of the year, but taking the whole of the Italian rye-grass produced, it will be seen that the average quantity of sewage applied from the date of sowing was 288 tons for every ton of rye-grass produced and cut. At ½d. a ton the tenant would have to pay 12s. for this, which is the value of the grass when cut, so that he would suffer a loss of all outgoings in the shape of rent, rates, labour, seed, &c. The waste exhibited by these figures is clearly due to the extreme porosity of the soil, and its unfitness for irrigation on that account.

A Proportion of Clay desirable.—With the limited time at command I must not enlarge upon the advantages certain soils have over others for irrigation. It may be sufficient to state that, if we desire to make the most of sewage, it is necessary that a proportion of clay should exist in the soil, and that, although very stiff clays, from the difficulty attending their management, should be avoided, it is much more likely that soils may be too free than too stiff; I am now, of course, speaking of the retention of the fertilizing matter of sewage by the soil, and not of the process of filtration as a means of purification. That is quite another matter. That clayey land is more grateful for sewage is very distinctly shown by Mr. Morgan's report, for the same quantity of Italian rye-grass was produced from clay lands as from free soils, though Mr. Morgan informs me the former did not absorb more than 4000 tons per acre, which is a little more than one-third of the sewage applied to the Italian rye-grass grown on the free soils. I need hardly point out that the rapidity with which land will absorb sewage must depend, not only upon the nature of the soil—its density and porosity—but equally upon the inclination of the surface over which the sewage travels, and the character of under-drainage beneath, and that, therefore, it is the duty of the engineer, when laying out land for absorption, to regulate the inclination of the surface, and the number, position, and size of the under-drains *upon which the effect mainly depends* according to the degree of porosity of the soil, in order that a given quantity of sewage may go as far as possible.

Filtration.—Having dwelt upon the practice of irrigation, I ought now to explain the process of intermittent filtration as it may be carried into practice, but as I shall presently deal with it when considering "land as a purifier of sewage," I will only state that by adopting the process as technically described the liquid refuse of from 1000 to 3000 persons—and probably more—may be cleansed by the soil of a single acre of land.

Return from Irrigation.—Up to this time, though sewage-farming has been practised for some years, we have not obtained sufficient data for the guidance of those who desire to follow it as a business. Although local boards and companies have had the farms in their own hands, no balance-sheets, showing the quantity of sewage applied to, and the money realized by the sale of the various crops grown, have been published. Still, the occasional results that have been obtained afford us positive evidence of what will be done under the management of men practised in the cultivation of land.

The following table exhibits certain results obtained at various places at different dates:—

Description of Crop.	Year of Production.	Place.	Value of Crop per Acre.
Italian Rye Grass.....	1868 ...	Norwood	£22 0 0
	1869 ...	Lodge Farm, Barking.	25 0 0
	,, ...	Norwood	25 0 0
	,, ...	Edinburgh	32 0 0
	1870 ...	Lodge Farm, Barking.	37 0 0
	1871 ...	,, ,,	22 0 0
	,, ...	Warwick	12 14 0
	,, ...	Banbury	13 16 10
Mangolds.....	1870 ...	Lodge Farm, Barking.	32 0 0
	1871 ...	,, ,,	44 0 0
	,, ...	Warwick	26 5 0
	,, ...	Rugby	21 9 0
Swedes.....	1871 ...	Warwick	26 5 0
	,, ...	Rugby.....	18 15 0
	,, ...	Banbury	14 6 8
Carrots.....	1869 ...	Lodge Farm, Barking.	38 0 0
	1870 ...	,, ,,	45 0 0
	1871 ...	Rugby	45 0 0
	,, ...	Warwick	35 0 0
Parsnips	1868 ...	Lodge Farm, Barking.	35 0 0
	1870 ...	,, ,,	35 0 0
	1871 ...	,, ,,	52 0 0
	,, ...	Warwick	35 0 0
Cabbages	1868 ...	Lodge Farm, Barking.	35 0 0
	1870 ...	,, ,,	15 0 0
	1871 ...	,, ,,	24 0 0
	,, ...	Banbury	21 11 6
	,, ...	Warwick	35 0 0
	,, ...	Rugby	15 0 0
	,, ...	Merthyr.....	20 0 0
Potatoes	1869 ...	Lodge Farm, Barking.	33 0 0
	1870 ...	,, ,,	25 0 0
	1871 ...	,, ,,	18 0 0
Onions.....	1869 ...	,, ,,	38 0 0
	1870 ...	,, ,,	62 0 0
	1871 ...	,, ,,	104 0 0
	,, ...	Warwick	35 0 0

From these instances sufficient proof is afforded that, with one crop per annum of a kind that will yield largely to the application of sewage, and command a certain and ready sale in the neighbourhood, a sufficient return may be gained to pay a full rent for the land and a halfpenny a ton for the sewage, besides affording a good profit after paying all outgoings in the shape of rates, taxes, hand and horse labour, repairs and restoration of implements, seeds, interest on capital, &c. It is true that crops as large and even larger than those grown with sewage have been produced by good farming without sewage, and there would be nothing to say specially in favour of irrigation, were it not that the *united* advantages of manure and water ensure crops year after year under every vicissitude of season, and allow of two crops being taken from the same land occasionally. From the experience gained in the cultivation of Italian rye-grass, it is found that it may readily be grown in excess of the demand for it in a green state, and that, as this description of grass is most difficult to convert into hay, it is desirable to limit its growth to a narrower space. It absorbs and appropriates, however, a larger proportion of sewage than any other description of crop, and it is only because it thus helps to swallow up sewage that it is continued to be grown by those who seek rather to get rid of the sewage than to make the most of it. That speciality loses its force directly a fair value is put on the sewage, or when sewage is applied to land which is itself capable of absorbing and cleansing it, as in such case the manurial matter is stored in the soil for use by following crops.

Return from Intermittent Filtration.—The acreage return to the cultivator from the growth of crops on land used for intermittent filtration will depend upon the extent to which the intermittent principle is extended. If several series of filtering-beds are adopted, as I have advised in the case of several towns, among which I may mention Birmingham, where the Sewage Inquiry Committee have declared their intention to adopt it, the return will be found to be quite as great, if not greater, than that to be obtained from irrigation; for with the land rendered actively absorbent by drainage and deep cultivation, and laid up in bouts or ridges, crops may be grown while the sewage is being applied without suffering from excess of wetness. By extending the filtering process from one series, as suggested by the Rivers Pollution Commissioners, to several series of areas, so as to give two or three years rest from filtration, such lands become available for the growth of the greatest amount of vegetation that can be produced from the land; for with the sewage at command, any amount of watering that the crops require can be obtained by diverting the sewage for a time from the filtering areas in use. At Merthyr, the money realized by the sale of crops, comprising various roots and cabbages, grown between the 14th June and 31st August last, amounted on an average of a day's sale by auction, to £17 15s. per acre. while the crops which were sold afterwards realized upwards of £20 an acre. These figures will bear comparison with the returns from irrigation proper; and I may here state that although the works have been very costly, owing in a great measure to their being the first of the kind carried into execution, and in being themselves the result of Chancery proceedings, the chairman of the Board (Mr. William Jones, of Cyfarthfa), says in a letter to me that much as the land and works have cost, "the filtering areas may yet pay;" adding that "had we obtained the land at a fair agricultural value, and the works been executed at the cost they would now be executed for, with acquired experience, I have no hesitation in saying they would be a source of great profit to the ratepayers of this district." These figures and the chairman's opinion are encouraging, and show a fair prospect of profit, if the authorities who have charge of such works abstain from growing the more refined kinds of gardeners crops, which involve expensive hand-labour, and which are dependent on very fickle markets for sale.

Many considerations lead to the conviction that it will seldom be within the power of the sewer authorities of towns to adopt the widest use of sewage, which would result in the provision of one acre for rather more than 40 persons, if we adopt the rate I have before stated, of 62 persons to one acre, with an allowance of 50 per cent. additional land for increasing population. With constantly arising opposition based on a fear of a nuisance (which under proper management will not arise), the difficulty of obtaining land, and the high price to be

paid for it, will always stand in the way of wide irrigation. To compensate for the limitation these obstacles will impose, it must not be forgotten that the produce of sewage farms loses much of its value directly it over-reaches the home market, and with a large area used for irrigation in the neighbourhood of a town this may be easily done. Already we hear of the produce of the Warwick Sewage Farm being sent to Birmingham, and that of Romford to Liverpool, and various instances of a like kind might be mentioned. One great advantage in the adoption of intermittent filtration, in the shape of concentrated irrigation, is that a greater variety of crops may be grown, and the overstocking of the market with vegetables avoided, inasmuch as by giving each series of filtering areas a rest of a year or two, the growth of cereals and other crops, which are not successfully grown by ordinary irrigation, would take their part in rotation, and thus dispose of those manurial elements which might otherwise be left in the soil.

It would be too sanguine a view to suppose that the ratepayers of a district adopting the filtration process in its narrowest form would receive as much for their sewage as when irrigation is adopted under advantageous circumstances, in its widest form, but it is more than likely that, in a majority of cases, a better return may be gained from a medium course of action than from any other, though it is our duty, in a national point of view, to aim at making the most we can of the valuable matter with which we have to deal.

III.—Separation of the Excretal Closet Matter from the Liquid Refuse of the Sewer, and dealing with each separately.

As already stated, the treatment of the excremental contents of the closet separately from the liquid sewage of the sewers, is an object in which agriculturists must take a very great interest, though I have never yet met with any estimate of their value. Reverting, however, to the figures given as the value of the voidings of human beings, it would not be too much to take a fifth of the intrinsic value quoted (8s. 5¾d.), or 1s. 8d. per head of the population, as the value of that which is retained in the closet, and which is capable of separate treatment, and is easy of removal to lands which cannot partake of the liquid sewage.

As the subject of this paper is limited to the fertilizing powers of sewage and the purifying powers of soil, it forms no part of my purpose to discuss the question whether town authorities act wisely in maintaining such a species of scavenging as is involved in the removal of the excretal refuse apart from the liquid sewage. I am, however, prepared to state that, having examined several dry processes now in use, there are some that may be adopted without objection, though it cannot be expected that the occupiers of superior houses who have once enjoyed the comfort of well-supplied and well-constructed water-closets should abandon the advantage and resort to dry closets of any description. At Rochdale Alderman Taylor has patented a plan which is now in use there. Beneath each seat a receptacle containing a small quantity of disinfecting fluid is placed, in which the fæces and urine are collected. The receptacles are removed in a covered cart weekly, or more frequently if required, to a manufactory on the outskirts of the town. There they are mixed with fine ash reduced from the cinders and dry refuse collected from the houses. The larger cinders, when separated from the ash, are sold. The average price realized for the manure mixture has been 17s. per ton, affording a profit, after deducting all expenses, of 2s. 5d. per ton. At the price mentioned, the manure is readily sold, and I can well believe is of great value to the farmer, particularly for certain descriptions of grass lands.

In large manufacturing towns, where water is much required in the trade that supports the population, and where it is desirable to economize as much as possible its use, and therefore to avoid water-closets, Alderman Taylor's process has much to recommend it, and from personal observation I am able to declare that it is free from the many objections that attend badly constructed and badly managed water-closets. In fact, I examined many closets attached to cottages in Rochdale which were much more creditable than many of the water-closets attached to large establishments in the metropolis.

But whatever may be done with the excretal matter by dry appliances, it will not be possible to avoid the proper disposal of the sewage of the sewers, and that will still have to be done by one of the classes of treatment already explained.

In small towns and villages it is still to be hoped that the dry-earth system, invented by the Rev. Henry Moule, may be more generally adopted. The experience gained, however, shows that the frequency with which the closets get out of order, and the difficulty of supplying and removing the earth, are such that, unless a system of management is organized and enforced, they cannot gain much ground.* Where there exists a proper officer, with assistants, if necessary, to supply the earth and remove the soil, and to keep the closets in working order, it is impossible that anything can be more suitable for isolated establishments and country villages; and when it is remembered that the difficulties of providing a public supply of water to villages are such as to be insurmountable in many cases, and that the leaky condition of the privy and cesspit maintains the soil in close villages in an excrement-sodden condition, resulting in the pollution of tank or well water, it does appear almost incomprehensible that the governing powers of this country should permit the continuance of the present state of things.

Land as a Purifier of Sewage.

Having spoken of the general purification of sewage by land, when treating of irrigation and filtration, it is only necessary to add a brief description of the process of intermittent filtration, as it has been carried out under my directions at Merthyr Tydfil. There 20 acres of land have been laid out for the purification of the sewage of the district, of which the dry weather flow at the time when the works were commenced amounted to 870,430 gallons per diem, the least flow during the day being 500 gallons; and the greatest 663 gallons a minute. The population contributing this sewage exceeds 50,000, but at present less than half the houses are connected with the sewers, so that the sewage may be taken as equivalent to the discharge of about 30,000 people. The number of water-closets being few, the sewage may be considered to be weak. Upon occasions of rainfall (which is above the average), the flow of the sewers is much increased, the storm waters frequently raising the discharge at least 50 per cent. above the ordinary dry weather flow, and this excess find its way to the filtering areas. The 20 acres of land were divided into four equal parts, and before forming the surface to receive the sewage the whole was drained from 5½ to 7½ feet deep, and deeply cultivated. By this means 2 cubic yards of soil for every square yard of service became serviceable as filtering material, there being but very few rods of ground in which the full depth of 6 feet was not secured. The quantity of filtering material was fixed upon so that the maximum quantity of sewage which would at any time have to pass through each cubic yard of soil would not exceed 7½ gallons per diem, while the mean quantity of dry weather sewage would pass through at the rate of 5 gallons per cubic yard. The under-drainage was so designed that no sewage could travel over the surface directly above the drain, which is the case in instances of irrigation of free soils in which the results have not been so favourable.

Here the result has been the most complete purification of the sewage up to this time, and the realization of the fact that the effluent water from the under-drains was as pure when the whole of the sewage was passing through half the filtering areas—viz., 10 acres—as when it passed through 15 and 20 acres, showing clearly that a less number of acres than 20 acres would suffice for the purification of the quantity of sewage dealt with, and that, therefore, if the sewage had been double the strength or double the quantity, as it may ultimately be when the whole of the sewage of the 50,000 persons is discharged by the sewers, there will be a certainty of complete purification of the whole if the board manage the works efficiently now they are completed.

During the period when the existing sewage, increased at times by the rainfall, was discharged upon the 10 acres (half the areas), they were receiving as much as 144,000 gallons per acre, which is equal to a depth of nearly 6½ inches, and never less than 72,000 per acre (equal to a depth of 3½ inches).

Instead of following the mode of distribution usually adopted in sewage irrigation when the fluid is either run over a regular surface, or along the ridge to flow over the slopes on either side, the surface of the Merthyr filtering areas was laid out in the ridge and furrow form, as before explained, the object being to allow of the use of the horse and hand hoe, and while growing crops on the ridge to allow the sewage to flow in the furrows, and rise up to the ridge sides with a certainty of being absorbed and of feeding vegetation at the same time. This treatment has been so successful that, in spite of the deposit of the finer particles of floating matter in the furrow, the whole of the sewage has disappeared within four or five hours after application, and the land has acted as a purifier up to this time in such a way that the effluent water from the under drains is pronounced by Dr. Benjamin Paul to be cleaner than the Thames water above the intakes of the metropolitan water companies. In order that its condition may be compared with the standard suggested by the Rivers Pollution Commissioners, I here give the analyses of the discharge from the 10 and 15 acres, when the whole of the sewage was run through those quantities of soil:—

Results of Analyses in Parts per 100,000.

	Effluent Water from 10 Acres.	Effluent Water from 15 Acres.
Solid contents—Total	39·00	55·00
" " Fixed	34·00	34·00
" " Volatile	5·00	21·00
Ammonia	·082	·086
Organic matter	·018	·011

Though it is a subject of personal satisfaction to me to have been the first to test, by designed operations, the process of intermittent downward filtration, suggested by the Rivers Pollution Commissioners, and to prove by direct evidence that the objections they anticipated can be avoided, the result might have been expected from the circumstance that in every case where sewage has been utilized on land, and allowed to pass through the soil as well as over it, the effluent water has been perfectly satisfactory. This will be seen by the following analyses of effluent water discharged from lands which have absorbed the sewage without any overflow from the surface, and without being laid out for intermittent action, except in the case of Merthyr Tydfil, which I have described.

Parts per 100,000.

Date.	Place.	Total solid matter in solution.	Organic Carbon.	Organic Nitrogen.	Ammonia.	Chemical Authority.
1868.						
Sept. 10 ...	Bedford	76·8	·575	·163	·023	Rivers Pollution Commissioners.
" 23 ...	Carlisle	28·8	·591	·204	·025	"
" 24 ...	Penrith	21·9	·320	·108	·001	"
1870.						
July 9....	Convalescent Hospital, Walton	10·87	..	·002	·002	Dr. Odling.
" 24....	Breton's Farm, Romford	70·60	..	·037	·003	Dr. Russell.
1871.						
Sept. 4 ...	Merthyr Tydfil	39·00	..	·018	·082	Dr. Benj. Paul.
" 4 ...	Lodge Farm, Barking	91·3	·676	·198	·005	Dr. Frankland.
" 12 ...	Tunbridge Wells	34·44	..	·060	·03	Dr. Voelcker.

If the proportions of polluting matter indicated in these analyses are compared with those contained in the effluent liquid discharged from the chemical processes to which reference has been made, or even with those of the effluents from the surface of lands over which sewage has been passed, the superiority of the combined effect of filtration associated with irrigation must be acknowledged. And on a study of all the facts such comparisons will expose, it will be manifest to every unprejudiced mind that, not only is it possible for town authorities to conform to a high standard of purity, but that, with a comparatively small quantity of land at command, it is a simple and inexpensive thing to do.

If this be true, ought there to be any hesitation in adopting a standard so high as to remove all doubt on the subject, with compulsory powers to enforce it?

We have had mournful proof that polluted water will find its way into the palace of the powerful as well as into the cottage of the poor; and our society has special reasons, in the very serious illness of our Royal President, the Prince of Wales, which has aroused the anxiety of the whole of the nation, and which is said to be traceable to impure water or sewer gases, for exerting all the power it possesses in preventing the public interests being sacrificed to the influence of water companies, and the false notions of economy which prevail with Local Boards of Health.

The Chairman said the importance of this question was hardly yet sufficiently realized by the general public. It was not in itself an attractive subject, and the public required to be reminded that sewage was one of those unsavoury realities which was inseparable from the present order of nature. The previous generation thought they had settled the matter when they employed water to carry away the refuse from the wear and tear of daily life, forgetting that by this means they were only taking it away from one place and putting it into another, thus converting the rivers and streams of the country into a gigantic nuisance. The rapid increase of populations in towns had made that nuisance perfectly unbearable, and the educated opinion of the country, expressing itself through Parliament, had decided that a great effort should be made to prevent the further pollution of rivers in this way. Several modes had been brought forward, which had been ably discussed by Mr. Bailey Denton, by which this could be effected, and he hoped to hear them fully discussed. There were two parties to the question—on the one side the masses of the population, who required defending in a matter in which they could not defend themselves, and on the other hand the agriculturists, who required the sewage, on account of its valuable properties, whilst between them stood the British ratepayers, at whose expense the process was to be carried on. It was, therefore, of great importance that the course adopted should be most efficient and economical; and, having been the first to discover that the soil had the property of decomposing ammoniacal salts and preserving them in a form in which they could be available for vegetation, he felt great interest in this question, and hoped to hear it well discussed.

Dr. Voelcker said they had had a great many discussions on the purification of sewage of towns, and, although valuable information had been brought forward, one point of view had not been dwelt upon—viz., the importance of the condition of the land by virtue of which it became a purifier of sewage; and therefore he begged to congratulate Mr. Denton on having specially insisted upon the necessity of rendering land a fit filtering medium, for it was only then that the sewage was effectually purified. He had long made up his mind that the land should be the means of effectually dealing with sewage. Whether

* For description of a means of dealing with slop and scullery refuse by Field's self-acting syphon, see "Village Sanitary Economy," in *Journal of the Royal Agricultural Society*, vol. iv., s.s., part 1.

it should undergo a previous treatment or not would depend on a variety of conditions which it was not necessary to go into; but, finally, the land must be looked to as the means of disposing of an intolerable nuisance, such as the sewage of towns had become. He was very much interested in the account of the experiment at Merthyr, which confirmed him more and more in the opinion which he had repeatedly expressed, that if the maximum and practical value was desired—in other words, to extract as much money from sewage in the shape of crops as possible—they should endeavour to put as much sewage on the land as it would take. The chairman had alluded to the fact that the soil possessed the marvellous power of absorbing ammonia, and retaining the fertilizing ingredients, such as phosphoric acid and potash, which were the most important. It should also be borne in mind that whilst the land possessed the power of retaining a certain amount of ammonia, this power was not only limited, but the ammonia was rapidly destroyed, and became changed into nitric acid, which was eliminated in the drainage that flowed from the land, and so was lost; so that there were no means of storing up in the soil any large amount of ammonia. If they wished to obtain the maximum value from the nitrogenous constituents contained in the clear liquid of sewage, they must endeavour, therefore, to grow crops whilst the sewage was in the land. His name had been mentioned in connexion with the phosphate sewage process. He would mention that he had nowhere expressed any opinion upon the commercial bearing of this matter, but merely that the phosphate sewage process, patented by Dr. Forbes, so far purified the sewage, if carefully practised, that the water was admissible into a stream of running water. Then Mr. Denton had taken exception to a statement which he had made—viz., that whilst manure of some value could be extracted by this process, the fertilizing properties of the clarified liquid, instead of becoming diminished, were just as good as they were in the original liquids, and, in fact, rather better. The matter was very easily cleared up if it was remembered that the sedimentary matter in sewage had very little fertilizing value, the fertilizing properties being contained in the perfectly dissolved substances. Manure of some value was obtained in the deposit if they previously put in something of value in the actual process of purification. The value of the deposit would therefore depend upon the value of the material put in; but it was perfectly possible to obtain by precipitation a manure of some value, and at the same time render the effluent water not the less valuable, but rather more so as an irrigation agent.

Mr. R. Rawlinson said the tendency of modern civilization was to mass human beings in towns, and where towns existed there must be sewerage, because the fluids necessarily used in town communities must be removed in some way, and unquestionably they would always be best removed by means of underground conduits, sewers, and drains. Whatever might be done with the dry-earth system in towns or villages, there must be underground drains to take away fluids; and that being granted, it was a matter for consideration whether the water thus flowing should not be made use of to carry away the small proportion of impurities generated by human beings in places where it could be dealt with by one operation, instead of dealing with it, as in the dry-earth system, by a multitude of operations, continued daily, or at least weekly. Some who had tried the earth system were sorry for it, and no wonder, considering the perpetual intervention from outside which was required. Sanitarians had been found fault with, because, in the first instance, cesspools having been the growth of a former period, when the sewage question was not understood, and water-closets having been introduced at the beginning of the century, when there was a prohibition generally against the existing drains being used as conduits for sewage, these cesspools were dug; but it was unavoidable under the circumstances, and in London they existed very recently by thousands and tens of thousands, and he was not sure there were not thousands in existence now. Windsor Castle, after an expenditure of three-quarters of a million to render it a fit habitation for Royalty, in 1844 was found to rest upon 53 cesspools full to overflowing; and the first Board of Health, which was established in 1848, met at Gwydyr House, which was found on examination to contain in its basement nine overflowing cesspools. He could not help alluding, therefore, to the great inconsistency in all legislation affecting matters of health that the metropolis should be exempted. London, of all the places in the empire, remained governed by 45 or more parish vestries, who had charge of the streets and sewers, while the Metropolitan Board, which was established for a special purpose, had charge of the intercepting sewers. There were various building Acts—perhaps the best ever framed—but there was no law with regard to house-drains; and there were houses all over London, especially in the West-end, which were not drained into—that is, connected with the sewers. They had been separately drained, but not connected, and the evil was not found out until the whole basement was poisoned. He had been three years in his own house in London when he found out that it was in this condition. When speaking about it at the Architectural Society, he was told that he must have got into the hands of a bad jobbing builder, when his reply was that the owner and builder of the house was a member of that society's council. Mr. Bailey Denton had, as usual with him, most ably treated the question in all its parts; but he (Mr. Rawlinson) regretted that he had not separated them more. With regard to town communities, sewage was a thing to be got rid of, and it was a fallacy to speak of its being worth one halfpenny per ton. In some cases, towns might really be thankful to any person who would take the sewage away and deal with it agriculturally, so as to prevent its being a nuisance, without paying anything for it; and in other places they might fairly and reasonably be called upon to contribute towards the expense. With regard to the removal of the excreta, although he concurred with all the abuse which was lavished on the system of carrying sewage into rivers, still, if human life was the first element to be considered, any town had done a great and good work in purifying the habitations of 100,000 people, although they had for the time being polluted a stream, because no evidence had been given to show that the pollution of the stream in the country was one-hundreth part so injurious to human life as one cesspool crowded against a cottage in the town. Mr. Bailey Denton, in his admirable paper, which tens of thousands would read, showed how pollution of rivers might be prevented, and by his works demonstrated on a practicable scale that town sewage may be so treated as to prevent it being a nuisance. That was the lesson to be studied, learned, and put in practice.

Mr. W. H. Michael joined with Mr. Rawlinson in regretting that the paper had taken so wide a scope, for he thought one of the topics treated in it would have been quite enough for discussion. There were two things in opposition to one another which ought to be taken into account in considering this question—first, that it was the interest of Town Councils to have as small a place as possible devoted to irrigation purposes, if that plan were adopted; and, secondly, that it was the interest of farmers to have as large a space as possible that could be effectually irrigated, so as to obtain the largest amount of crop. Therefore, while 40 persons to an acre might be sufficient for one purpose, 3000 might be better suited to the other. He doubted if they were in a position, from one isolated experiment, to give any answer to the question whether intermittent filtration was proved to be effectual when joined with vegetation on the surface. If it had been found that cesspools in constant use had so polluted large areas of ground as to poison the whole of the water in the neighbouring wells, how could it be hoped that, after the same lapse of time, intermittent filtration would not so overload the quantity of earth used that it would, after that period, cease to discharge the duty which it had at first amply fulfilled? He did not think the simple experiment performed by Dr. Frankland was sufficient to enable them to speak definitely on this point without further and more extended experience. If it were so, they would have arrived at the solution of the difficulty, because one of the difficulties which was constantly meeting the Local Boards and those who advised them was the large area of land required to carry out sewage irrigation; and if it were found that one acre of land was sufficient for a population of 3000, and this fact were proved, the difficulty would be removed. There was no reason to suppose that the Government was going to do anything to help in this matter. By laying down any chemical formula, as to the absence of pollution, they would not really assist, nor could Government be expected, as preservers of the public health, to say what scheme should be adopted. It had gone quite as far as was proper, when it said to all public bodies, you are not so to deal with your sewage as that it should be a public nuisance. With great deference to Mr. Rawlinson, he could not agree with him that any town was justified in changing one form of pollution for another, or in polluting rivers instead of wells. He was also surprised to hear what Dr. Voelcker had said with regard to liquid sewage. It could not be too much insisted upon that the solid matter was utterly valueless, but he thought it was going too far to say that it might be entirely eliminated and yet leave the liquid sewage really more valuable for irrigation purposes. Mr. Baldwin Latham had done a great deal by perfecting the process for getting rid of the solid matter, but he could not understand how it could be said that by adding something to sewage you could clarify and purify it, and yet make it more efficient for irrigation purposes; the two things seemed perfectly opposite to each other. He understood the doctor to say that you might add something to the fluid which should take away the ammonia, and yet the ammonia being the only thing which comparatively rendered the sewage valuable, should be all the more valuable after it had been removed. In conclusion, he thought it very surprising, after the utter worthlessness of chemical methods had been demonstrated, they should still be advocated by some parties. He referred to the A. B. C., and other frivolous modes, the advocates of which were always promising to do something, but their promises were never fulfilled. They acknowledged they did not take away the ammonia, which, being a matter which became putrescible, gave all the trouble, and that the manure when made was of so subtle a character that it was entirely beyond the province of chemists to distinguish its fertilizing powers. He was surprised, therefore, that people should be found ready to throw their money away in a process which absolutely required the expenditure of £10 worth of material in order to produce a manure worth about £5, and hoped they would soon hear the last of A. B. C. or X. Y. Z. processes, which only stood in the way of more efficient modes of dealing with this question.

Mr. Rawlinson said he had in no way advocated the pollution of rivers.

Dr. Frankland said he had listened to the paper with great satisfaction, though he wished the author had omitted the latter part, which treated of the old system of dealing with refuse matter. He agreed generally with Mr. Bailey Denton, but he had, he thought, failed to distinguish between two separate things—the purification of sewage water, and the extracting from it the manurial ingredients. These two subjects were very frequently confounded. You might purify sewage by transforming its polluting into non-polluting ingredients, so that it might be admissible into any stream without the possibility of creating any nuisance, and not extract from it one particle of its manure value; and in that respect he quite agreed with Dr. Voelcker, although he was not prepared to go so far as he had with regard to the purity of the effluent water produced by the phosphate of alumina process. On the other hand, it was also possible to extract certain manurial constituents from the sewage without completely purifying it, and by the aid of plants and soil you could also extract the valuable constituents from the sewage, and store them up in the tissues of the plants to a considerable amount, still leaving a very large portion of valuable though non-polluting particles in the effluent water. This was what had been accomplished at Merthyr, as he could testify from an examination of the works and the effluent water. Mr. Denton had there shown that the system of intermittent filtration, which had been experimentally successful in the laboratory of the Rivers Commission, where it was devised and tried, could be applied on a large scale under certain conditions, and with the additional advantage, which was not at first contemplated, that a certain amount of agricultural produce could be grown at the same time. The soil at Merthyr was very favourable, being sandy and porous, allowing the sewage to pass regularly and slowly through it, whilst, at the same time, it allowed of very perfect aëration, a condition which was essential to success. Moreover, the sewage of Merthyr was only of about half the average strength of town sewage, but at the same time the effluent water was so pure that if it contained twice the per centage of impurities which it did, it would still fall considerably within the standards of the Rivers Pollution Commissioners. Many persons drank it, though that was no criterion, for he had seen people drink slightly clarified sewage with avidity, and declare it was excellent. It was asked whether filters constructed on this plan might not become choked and useless, and he might admit the possibility, although it would be contrary to the experience which he had had as yet on a small scale in the laboratory, where he had found no choking of properly aërated filters; he had observed even no tendency that way, although they had been in some cases kept at work for periods varying from one to two years. With regard to the amount of valuable constituents present in sewage, which could be extracted in this way, and converted into marketable produce, they could not expect to compete with more extended irrigation, and, as a matter of fact, the effluent water from the Merthyr filters contained half of the fertilizing ingredients present in the original sewage; but this waste went on upon sewage farms almost everywhere to an extent not at all appreciated by those who were applying the irrigation process. It was no uncommon thing to find a quarter or half, nay, in some cases, seven-tenths of fertilizing constituents of the sewage going away in the effluent water, even on the most successful sewage farms. They might, therefore, look forward to getting a much larger amount of produce out of a given quantity of sewage than had yet been obtained. He should be glad to see experiments made in this direction, and the effluent water, which still retained fertilizing constituents, applied to subsequent portions of land, in order to ascertain whether it would not produce as good crops as the original sewage.

Mr. Baldwin Latham said it was very gratifying to those who had taken the lead in the question of how to dispose of sewage so as to effect its purification, to find that Mr. Bailey Denton had become a convert to their views; for it was but about two years ago the author stated in this room, when his paper on rural water supply was under discussion, that there was no means of purifying sewage, and yet in the short time that has elapsed he comes forward as one of the boldest champions of the cause he formerly condemned. Still, he must say that there were some points on which it was not clear that Mr. Denton had arrived at the right solution of this great question. The subject of intermittent filtration had been spoken of as carried out at Merthyr under exceptional circumstances. He feared that the system could not be carried out so successfully everywhere. For example, see what is proposed to be done at Birmingham. Mr. Denton proposes to apply all the sewage to 800 acres of land. At the present time Birmingham stands upon upwards of 5000 acres of land, and has its thousands of cesspools studded over this area. From these cesspools subsoil intermittent filtration was going on, and yet what are the results? The subsoil water of the district is so poisoned as to be pronounced unfit for domestic purposes. What, then, will be the result when the sewage of this large district is concentrated on some 800 acres? He did not say that the effluent water would be injurious when flowing in the natural watercourses, as nature has provided in the air the means of oxidizing any escaping deleterious matters, but he could conceive that such effluent water would still be poisonous in the sense in which sanitarians look upon impure water. This method of intermittent filtration was certainly not the goal to which sanitarians and agriculturists are looking; who, on the one hand, are anxious to reduce the agents destructive to life to a minimum, and, on the other hand,

to get the greatest value for the fertilising materials we have to dispose of. After paying constant attention for some years past to the subject of sewage irrigation, he must say that the conclusions arrived at by Mr. Denton with respect to the necessity of sub-drainage on all irrigation areas are not borne out in practice. Some soils, Mr. Denton admits, are too porous for irrigation, and he does not recommend these, but wherefore it would be difficult to find out, except that they do not require draining. Some soils are dense, cold, flat, and with no natural circulation. These soils require draining. His experience led him to know that when there is good natural drainage the cost of artificial drainage can be dispensed with. Moreover, in the case of land through which there is a thorough circulation of water when applied for irrigation, no drainage is required as an absolute element of success, as laid down by Mr. Denton. From the remarkable results that have transpired where sewage has been applied in large volumes to undrained land, he was led to form an opinion that there were some forces at work which had hitherto escaped our attention, and which give all the advantages of drainage without its cost. From a series of experiments carried on with various kinds of sand and soil, he had arrived at the conclusion that wherever the surface to which the sewage is applied has a given amount of inclination, a perfect circulation takes place in the soil to a considerable depth, and to depths below those to which the liquid would pass by ordinary gravitation. These conclusions he arrived at by making a series of experiments, first with silver sand and afterwards with other materials. The experiments are so interesting, and throw such a new light on the irrigation theory, that they were about to be repeated by his friend, Dr. Odling, at the Royal Institution. He would take one experiment, which he showed by means of a diagram. In a glass tank, 4 feet long, 12 inches deep, and 6 inches wide, was put silver sand saturated with a solution of perchloride of iron. The tank was inclined at an inclination of 1 in 100 at the upper end; an infusion of nut-galls was allowed to pass into it drop by drop. By natural gravitation, the water would have penetrated to a depth of 6-10ths of an inch at the upper end and nothing at the lower; yet, after eight pints of the effusion had been applied, it showed that penetration had taken place to a depth of nearly 5¼ inches, and every increase in the quality applied increased the depth of the penetration. The apparatus formed its own diagram, for all the perchloride was displaced by the galls; but at the point of junction, owing to the formation of tannate of iron, a clearly defined line was visible, and until this line reached the lower end of the tank nothing but perchloride of iron came over. In order to ascertain that these results did not arise from simple diffusion, a quantity of the same material was placed in a glass jar and kept at rest, yet, in six months, the colour had not penetrated the sand more than a quarter of an inch. The tendency of these experiments was to show that a given volume of sewage passed on an irrigation area first displaces a given amount of subsoil water, and that afterwards every increase of sewage passed on displaced a former increasement, so a constant circulation is taking place in the soil, and every particle of sewage is thus brought intimately in contact with the soil. Drainage promotes circulation, but the experience of all the larger irrigation works in Europe unmistakeably points out that a circulation is promoted by the application of large volumes of water to properly prepared surfaces. Of the thousands of acres irrigated in Piedmont, Lombardy, and Spain, under-drainage is not resorted to, and yet the value of irrigation in these cases is tested by the proportion of the water applied. The larger the quantity, the more valuable the undertaking. The conclusions, therefore, to be drawn are these, that when there are good natural falls, with a large volume for application, under-drainage is not an absolute requirement, but if there is no fall, circulation must be provided by under-drainage. Now, as sub-drainage adds enormously to the cost of irrigation works, and has not always proved successful (as at Norwood, where the drains have been taken out), it is a point gained to know where and when they may be adopted, and where dispensed with, for the more certain and less costly we can make irrigation works, the more hopefully will the system develop, to the common advantage of all.

Mr. Hope asked if the tank was filled with wet or dry sand.

Mr. Latham said the tank first had 5½ gallons of the perchloride solution put into it; the sand was afterwards added, and it was then allowed to rest, to ensure saturation and settlement before commencing the experiments. It was curious that, at whatever point the galls were applied, if there was an inclination of surface the liquid penetrated to a considerable depth; but if there was no inclination of surface, and movement over the surface, there was no penetration. The same results again occurred when the iron was passed through the tank, after the galls had displaced the former perchloride of iron.

Mr. Hope said he could conceive it was within the bounds of possibility that such a process of circulation might take place in rough, coarse sand, but, as a matter of fact, on catch-water irrigation farms the water could be followed, flowing along the surface of the land, and flowing off. As a matter of fact, there was no circulation, whatever the theory might be; and if it was considered that land irrigated for months or years successively became completely lightened by the action of the water, it was evident that such circulation would be impossible. If there was one axiom in agriculture more thoroughly adopted than another by all men of experience, it was that you must drain land, and if you added to the natural moisture or rainfall on the land a large quantity of artificial moisture, in the shape of sewage, surely the drainage was none the less necessary. He had listened to Mr. Denton's paper with great pleasure, and agreed with him so completely that he would not occupy time in discussing those few minor points on which he differed. Dr. Frankland had pretty well disposed of the question of cesspools and filtration, pointing out that the completeness of action was owing to the intermittent aëration of the filter, while the pollution of the cesspool was due to the constant saturation and non-aëration of the surrounding subsoil, two things radically dissimilar. With regard to the phosphate process, he would, if he might be allowed, venture to defend Professor Voelcker's view of its action on the effluent water. It was quite possible, although it had not yet been sufficiently proved, that that process might produce the solid precipitate, and at the same time enrich the effluent water, because the process of subsidence, which was purely mechanical, deprived the sewage of the bulk of the phosphate; and, as he understood, there was a process by which a certain amount of free phosphoric acid was liberated, which would replace the phosphate of which the sewage had been deprived. That, of course, had nothing to do with the question as to its commercial value. The great difficulty would be that the solid matter was obtained in the form of a nasty slush, containing some 90 per cent. of water, which would have to be driven off by some mechanical means. With regard to the A. B. C. process, he had not been at all converted by his recent visit to Leeds. It had always been put forward that some future operations were to be looked to to prove the value of this process, and he had been requested to examine the works at Leeds, but on doing so he was obliged to call in question the analysis published by the company at the meeting of the Local Science Association, which showed 4½ per cent. of ammonia and 9 per cent. of phosphate, as compared with 1 per cent. of ammonia and 2½ of phosphate, as shown by Drs. Frankland and Voelcker. The company had since admitted the accuracy of the last-named estimates, but they still claimed that their product was worth 70s. a ton, at which they were selling it, while this analysis showed it to be only worth 35s., and they were now obliged to fall back on the ingenious theory that there was some virtue in solid human excrement other than that disclosed by chemical analysis. It really resolved itself, therefore, into a question of what was the commercial value of mumbo-jumbo; for, whilst 35s. a ton represented the value of the ammonia and phosphate, the other 35s. could only represent the value of mumbo-jumbo. With regard to the suggestion that the effect of the effluent water containing inorganic nitrogen escaping from sewage farms should be tried upon fresh soil, in order to ascertain its manurial value, he feared that such an experiment would be disappointing, because the experiments conducted over so many years by Drs. Lawes and Gilbert showed that a certain waste of nitrogen was unavoidable. As far as he could ascertain, it was impossible to obtain the commercial result due to a given quantity of ammonia without the loss of the inorganic nitrogen. The question was very abstruse and difficult to experiment upon, but the observations of M. Cloez in France went to show that the majority of plants had no power to assimilate ammonia at all, but only nitrogen, in the inorganic form. It was impossible to say whether or no that was the case, but he feared it was not, and that Dr. Gilbert was right when he said that the inorganic nitrogen was only taken out of the soil in a long course of years. The real secret of the waste of nitrogen in the effluent water was that the quantity of manure applied was far in excess of the possible requirements of the plant. He had previously stated that land would not take the sewage of more than from 20 to 25 persons per acre, and after two years experience his belief was it was impossible to get the value from the sewage of more than 20 persons per acre, for it was very easy to overburden the market with garden produce, and the bulk of manure, therefore, must be converted into more portable produce, such as cereals. Having given great attention to this subject, he believed it might be so applied, and that the bulk of the sewage would be so used in a few years time. From perhaps the 1st of September to the 1st of May sewage might be applied to cereal crops with advantage. In the earlier part of the time it might be used to produce a crop of mustard, which would afterward be ploughed in, and there was no better preparation than that for wheat. At a later period it might be applied directly to the wheat, after that again to fallow land in preparation for either wheat, barley, oats, or beans. Then, again, in spring it could be applied to cereals sown in the autumn which did not receive any sewage at that time. In this way they would get the greatest return with the minimum of outlay, and at the same time the minimum of uncertainty as to a market. With regard to Mr. Latham's remarks about Birmingham, he felt rather sore on that point, because he had recommended what was practically the same scheme as he had formed many years for London, a small area of land as a sort of filter at the end of a culvert, with the power of selling the sewage to farmers right and left. He was now about to lay out for the Corporation of Birmingham about a thousand acres for the intermittent filtration of sewage, amounting to a daily average of about 16 million gallons. On his farm at Romford in last June, December, and January he had applied 6000 tons an acre continually to a portion of about seven acres, and the result was perfectly satisfactory, although the land had not been so thoroughly drained as it should be for such a purpose. This was at the rate of about 31,000 tons per annum per acre, and the 16 millions of gallons in Birmingham would be about the same proportion when applied to 1000 acres. Consequently he did not apprehend any danger from the operations proposed to be carried out there.

Mr. Spencer said he had been for fourteen years successfully engaged in the purification of sewage water, and, although not a thick-and-thin advocate of sewage irrigation, he was chemical adviser for the Liverpool Sewage Irrigation Company from the commencement. His own speciality, however, was the purification of sewage, and he believed he was entitled to claim the credit of introducing the method of intermittent filtration. For the last seven years he had purified the water of a narrow river, almost like a canal, and sewage from about 70,000 inhabitants went into the water that was given to the population of Wakefield to drink. Notwithstanding, there had been so much less disease since this process had been adopted, that he wondered more notice had not been taken of it. He was glad that Dr. Frankland had come over to his way of thinking as regarded intermittent filtration, though, in 1862, when he (Mr. Spencer) was engaged on a bill in Parliament for the purification of the whole of the tributaries of the Mersey and Irwell by this method, Dr. Frankland, being engaged on the opposite side, had laughed the idea to scorn, and the pamphlet in which he had advocated it was described as absolutely ridiculous. Now, however, the same method was described as the great panacea for all the evils of effluent sewage water. The fact was, however, that the whole efficacy of the process depended on the nature of the soil. If the soil contained no iron, the sewage might be filtered through it to any depth; and though it might be mechanically purified, it would not be in the least affected chemically, so that all the matters held in solution would still remain. Mr. Bailey Denton had spoken of the advantage of clay soils, but it must be red clay, containing iron; white clay, like white sand, would be useless for the purpose. So long, however, as the soil contained iron, the filters would be self-purifying. At Wakefield, the filters had not been touched for six years, except to scrape out periodically the deposited matter; and he had no doubt that at Merthyr, where the filters were found to work so satisfactorily, there was a large per centage of oxide of iron in the sand. It had been asked what became of the sewage matter, and how did the filter purify it; it must go somewhere. The answer was that it was destroyed by the power which peroxide of iron had of changing organic matter into carbonic acid, by a process precisely analogous to that which went on in the lungs.

A vote of thanks having been unanimously accorded to Mr. Bailey Denton for his able paper,

Mr. Bailey Denton said he did not like making observations upon what he did not fully understand, and therefore he would take an early opportunity of calling on Mr. Baldwin Latham, and having the nature of his experiment more fully explained; but, in the meantime, he would ask his audience to reserve their opinion upon the matter. He had been engaged for 25 years in draining, and all that time he had never yet known water to run uphill; and it seemed to him as if Mr. Latham's experiments showed that to be the case. In reply to Mr. Michael, he would say that he did not venture to contend that the experiment at Merthyr was conclusive, and one which should be held up as a pattern for all the kingdom to imitate; but, as far as it had gone, it was perfectly satisfactory, and he believed there were in the case such indications as enabled one to look somewhat into the future, and to say that, with the aid of vegetation applied to the area being used as a filter, and letting a portion rest for a period at intervals, during which it should be given up wholly to vegetation, the end aimed at might be accomplished. Mr. Latham had followed Mr. Michael in comparing so many thousand acres of excrement-sodden soil at Birmingham with the filter beds at Merthyr; but two elements were entirely absent. In the first place, there was no intermittent filtration; and, secondly, houses took the place of vegetation, which made all the difference.

Presentation to Mr. Hugh Baillie.—On Tuesday, Dec. 9, Mr. Hugh Baillie, manager of the Falkirk Gas-Works, was presented with a handsome gold watch and chain, subscribed for by a large circle of friends and well-wishers, as a token of esteem and respect, on the occasion of his leaving this country to assume the managership of the gas-works in Bahia, Brazil. The meeting at which the presentation was made was largely attended. James Neilson, Esq., presided, and in appropriate and complimentary terms expressed the feeling entertained towards Mr. Baillie by the party assembled and the community at large. Mr. Baillie had been engaged in Falkirk four or five years, and during that time had succeeded in ingratiating himself into the goodwill and good opinion of the inhabitants with whom he had dealings as a gas manager, and in his private capacity as a citizen. Mr. Baillie assured the company that he would always retain a high sense of the great kindness shown him; and thanked his friends sincerely for their valuable gift, which he would respect as long as he lived, and hand down as a prized heirloom to his successors. It would be his aim to prove himself worthy of the honour they had done him.

GAS COALS.

Scotch Cannel, f.o.b.:—	Per Ton.
Boghead—at Bo'ness, 57s. 6d.; at Leith	58s. 2d
Muirkirk	27 0
Kirkness, best (at Burntisland)	22 6
Capeldrae, 1st quality (at ditto)	22 6
Ditto, 2nd ditto (at ditto)	17 6
Cowdenbeath (at ditto)	12 0
Lockgelly (at ditto)	12 0
Donnibristle—at Burntisland, 12s.; at Aberdour	12 6
Auchinheath Lesmahago (at Granton)	27 0
Duke of Hamilton's Lesmahago (at Granton)	28 6

Scotch Cannel, f.o.b.:—	Per Ton
Arniston (at Leith)	21s. 0d
Wemyss (at Wemyss)	20 0
Haywood Co.'s Haywood (at Granton)	23 0
Pirnie, or Methill	17 0
Lothian's Cannel (at Leith)	24 6
Grange ditto (at Bridgeness)	17 6
Kinniel ditto, at Bo'ness	17 6
Myles' ditto	23 6
Lochore Parrot (at Burntisland)	25 0
Waverley Seam (at do.)	16 0
Lanemark (at Glasgow)	16 0
Elphinstone Tower (at Leith)	20 0

WEEKLY METAL REPORT.

(*From* J. Berger Spence & Co.'s *Circular.*)

Chemicals.—The trade is more animated than usual at this season of the year, manufacturers being fully engaged in every branch, at remunerative prices. The rise in values has been in a great measure brought about by the increased cost of the raw materials and of labour, and the industrial requirements being so much greater than for the last few years, has placed makers in a position to raise their prices to a point which will in some degree make up for the unremunerative working of late years. The consumptive demand for home trade continues large, and is likely to remain so. Caustic soda maintains its price. Soda ash is firmer, and makers hold out for full prices for next year's delivery. In bleaching powder more doing. Soda crystals are in better demand, and an advance of 2s. 6d. per ton is asked.

TURNER & ALLEN,

201, UPPER THAMES STREET,

London,

GAS & WATER ENGINEERS.

CONTRACTORS FOR THE SUPPLY OF

LAMP COLUMNS, LANTERNS, FOUNTAINS, PIPES, &c.,

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GAS, WATER, & RAILWAY COMPANIES, LOCAL BOARDS, SHIPPERS, &c.

Complete Pattern and Price Book, 3s. 6d. post free.

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LESMAHAGOW GAS COAL.

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Works—BLACKWOOD & SOUTHFIELD, LESMAHAGOW.

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JAMES MILLER, SON, & Co.,

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AND

75, UNION STREET, GLASGOW.

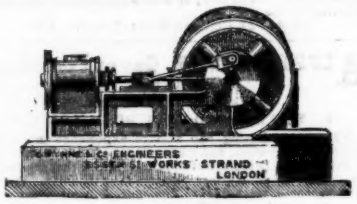

Fig. 213.

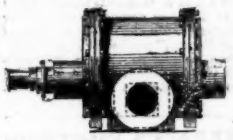

Fig. 211.

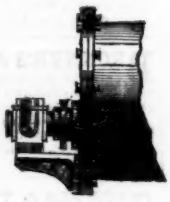

Fig. 219.

GWYNNE & COMPANY,

HYDRAULIC, MECHANICAL, & GAS ENGINEERS,

ESSEX STREET WORKS, STRAND,

London, W.C.,

SOLE MANUFACTURERS OF

BEALE'S IMPROVED PATENT GAS-EXHAUSTER,

Under the personal superintendence of Mr. BEALE.

REDUCED PRICES AND INCREASED CAPACITY.

Also manufacturers of Improved Hydraulic Regulators, to actuate a steam or gas throttle-valve to suit the make of gas; self-acting bye-pass valves, to move by hand or otherwise; improved stop-valves, with faced flanges, forming the neat adjunct to Exhauster of valve and elbow combined. Exhausters manufactured on the new principal have given the utmost satisfaction, and can be seen working at several large Gas-Works in London. **G. & Co. are now engaged in manufacturing the largest Gas-Exhausters in the world, with engines complete.**

The Gas-Exhausters may be made with inside or outside bearing, as shown in Figs. 211 and 219.

Fig. 213 shows the Improved Gas-Exhauster attached to, and driven by one of Gwynne and Co.'s well-known high-speed Horizontal Steam-Engines, without any intermediate gearing. This arrangement is extremely compact, and is beautifully adapted for small or large Gas-Works, and the foundations and erection are both very simple and inexpensive.

Prices and every information upon application to Gwynne and Co. *as above.*

DUKE OF HAMILTON'S
LESMAHAGOW GAS COAL.

The superior quality of this well-known Cannel, as wrought by

THE NITSHILL AND LESMAHAGOW COAL COMPANY,

Is now generally admitted by all Gas Engineers.

PRICE AND ANALYSIS MAY BE HAD ON APPLICATION TO

JAMES M'KELVIE, HAYMARKET, EDINBURGH.

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THE ORIGINAL

WORTLEY FIRE-BRICK WORKS

Near LEEDS,

MANUFACTURERS OF ALL DESCRIPTIONS OF

FIRE GOODS, and Salt-Glazed Drain-Pipes

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MARCUS BOURNE NEWTON,

Wharf No 4, inside Great Northern Goods Station, King's Cross, N.

Where is always kept a Stock of Retorts, Fire-Bricks, Terra Cotta Ware, and Drain-Pipes.

WANTED immediately, Three or Four STOKERS for the Gas-Works of a provincial town about 30 miles from London. They must be good scoop-drivers, not under 5 feet 8 inches in height, and under 35 years of age. Testimonials required.

Address W. M. O., care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WORKING MANAGER WANTED.

WANTED, for a small Gas-Work in South Wales, a steady working man as MANAGER. He must be able to lay mains, services, &c., and to do all work required in a Gas-Work. Wages 30s. per week, with fire and gas. He must be able to enter upon his duties immediately.

Send testimonials to B. G. W., care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Man to Manage a small Gas-Works. One accustomed to the use of clay retorts preferred. Cottage and rates free. Coal and gas allowed.

Apply, stating wages, to Mr. MARSHALLSAY, Secretary, Gas Company, Sturminster, Newton, DORSET, on or before the 22nd of December, 1871. Testimonials required.

WANTED, by a young Man, a situation as Meter Inspector, Fixer, Index Taker, &c.

Apply to A. B., care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a young Man, an engage- ment as GENERAL MANAGER. Is thoroughly conversant with the manufacture of gas and the whole routine of a Gas-Work, the keeping of accounts, and carrying out of extensions and alterations. Good testimonials.

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TO GAS COMPANIES AND OTHERS.

THE Advertiser, a Mechanical Gas ENGINEER, is open for an engagement. Has now the management of works, make upwards of 14 millions. Can get out plans and specifications for the erection or alteration of works.

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THE Advertiser is open for an engage- ment as MANAGER. For the past six years has had the management of a work where the make is over 30 millions annually. The highest testimonials given.

Apply to A. D., care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE.—Four Purifiers, 10 ft. square, with centre-valve and connexions. Two Purifiers, 12 ft. square. A Beale's Exhauster, to pass 25,000 feet per hour, with governor and bye-pass. A Jones's Exhauster, to pass about 15,000 feet per hour. A Station-Meter, to pass 25,000 feet per hour. Mouthpieces, Hydraulic Main, and other apparatus suitable for Gas-Works.

Apply to the Tynemouth Gas Company, NORTH SHIELDS.

TO GAS MANAGERS AND OTHERS.

TO BE LET, for a term of Seven years, from the 1st of January next, the LLANTRISANT GAS-WORKS (Capital £2500). Any one understanding the business will find this a very eligible investment. A good house and garden is attached.

The Directors do not bind themselves to accept the highest or any tender.

All tenders to be addressed to the Secretary, W. JOHN, Esq., Brynteg, Llantrisant, GLAMORGANSHIRE, and must be sent in on or before Jan. 15, 1872.

Further particulars may be had on application to the Secretary.

TO TAR DISTILLERS AND OTHERS.

THE Directors of the Colchester Gas Company are prepared to receive TENDERS for the purchase of the whole or portions of the GAS TAR to be produced at their works, Colchester, for the term of One or more years, as may be agreed upon, commencing on the 1st of January next. The total quantity that will be produced during the first year is estimated at 60,000 gallons.

Sealed tenders to be delivered to the Chairman of the Colchester Gas Company on or before Thursday, the 11th day of January, 1872, and endorsed, "Tender for Tar."

The Directors reserve the right to reject any tender.

By order, J. ROWAN, Manager.

Gas-Works, Colchester, Dec. 9, 1871.

GAS TAR & AMMONIACAL LIQUOR FOR SALE.

THE Haverfordwest Gas and Highway Commissioners are prepared to receive TENDERS for the surplus TAR now at their works, amounting to about 50 tons. Also for the AMMONIACAL LIQUOR that will be produced at their works in the year 1872, quantity about 20,000 gallons. The Commissioners will deliver the Tar and Liquor at the Railway Station, or at their Quay, in casks, the casks to be supplied by the purchasers.

For further information, apply to Mr. JOSEPH GIBBON, Manager, Gas-Works, HAVERFORDWEST.

Sealed tenders to be sent to the undersigned, endorsed "Tenders for Tar and Ammoniacal Liquor," on or before the 1st of February, 1872.

The Commissioners do not bind themselves to accept the highest or any other tender.

THOMAS PERKINS, Clerk to the said Commissioners.

Haverfordwest, Dec. 16, 1871.

BOROUGH OF BARROW-IN-FURNESS.

GAS TAR & AMMONIACAL LIQUOR FOR SALE.

THE Gas Committee invite Tenders for the surplus TAR and AMMONIACAL LIQUOR to be produced at their works, for One or more years, commencing on the 1st of January next. The quantities will be about 40,000 gallons each per annum.

Particulars may be obtained on application to the Manager at the Gas and Water Works.

Sealed tenders, addressed "The Chairman of the Gas and Water Committee," and endorsed, to be sent in to me not later than Dec. 26, 1871.

The highest or any tender not necessarily accepted.

C. F. PRESTON, Town-Clerk.

Municipal Offices, Dec. 15, 1871.

BOROUGH OF BARROW-IN-FURNESS.

TENDERS FOR GAS COAL.

THE Gas Committee invite Tenders for the supply of about 2000 tons each of CANNEL and GAS COALS, to be delivered at their works in such quantities and at such stated periods as may be required, for Two years, from Jan. 1, 1872. The contract will be subject to arrangement as to variations in colliers wages.

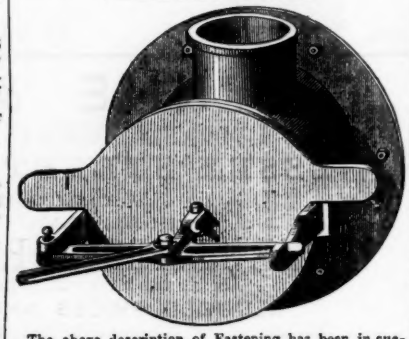
Further particulars may be obtained on application to the Manager at the Gas-Works.

Sealed tenders, addressed "The Chairman of the Gas and Water Committee," and endorsed, to be sent in to me not later than Dec. 26, 1871.

C. F. PRESTON, Town-Clerk.

Municipal Offices, Dec. 15, 1871.

BOX'S PATENT FASTENING FOR **RETORT-LIDS.**



The above description of Fastening has been in successful use for a considerable time, and can be supplied at a much more economical rate than the ordinary cross-bar and screw.

For prices and particulars, apply to W. BOX, Gas-Works, Crayford, KENT.

CLOTH GAS-BAGS for MAINS, as supplied to the Imperial, Chartered, and other London and Provincial Gas Companies. Bellows and Valves for inflating Well Dresses, Stokers Gloves, India-Rubber Suction and Delivery Hose, Gas-Tubing, Leather, India-Rubber and Gutta-Percha Machine-Bands, Sheet and Washers for Steam Joints.

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BELGIAN CLAY RETORTS.

J. SUGG and CO., late ALBERT KELLER, GHENT.—The removal of the import duties on Earthenware permitting the entry of Clay Retorts into England, Messrs. Sugg, of Ghent, beg to draw the attention of the Gas Companies of London, and other Cities, to the very superior quality of the RETORTS manufactured by them. They can be made of any size, in one piece, and of any form. The price will be in proportion to the weight, and very moderate in comparison to their value.

Communications addressed to J. SUGG & CO., GHENT, will receive immediate attention.

PHŒNIX GASLIGHT and COKE COMPANY.

NOTICE is hereby given that an EXTRAORDINARY GENERAL MEETING of PROPRIETORS, holding previous to the 19th of September last £300 and upwards capital in the said Company, will be held at the Bridge House Hotel, Southwark, on WEDNESDAY, the 20th inst., at One o'clock precisely. "To consider and determine upon a draft Bill, then to be submitted, for the amalgamation of this Company with the South Metropolitan and Surrey Consumers Companies; and for other purposes."

By order, I. A. CROOKENDEN, Secretary.

70, Bankside, London, S.E., Dec. 6, 1871.

MANUFACTURE AND DISTRIBUTION ACCOUNTS.

Mr. W. J. WARNER

Begs to say that in consequence of the number of inquiries he has received relative to the above form of Accounts, which he had the pleasure of submitting to the

BRITISH ASSOCIATION OF GAS MANAGERS, AT THEIR LATE MEETING IN DUBLIN,

he has been induced to publish them, and is now prepared to supply the two sheets, post free, for 5s.

Applications to be made to

Mr. W. J. WARNER,
Engineer,
GAS-WORKS, SOUTH SHIELDS.

BOOKS FOR GAS ACCOUNTS.

ALFRED DOUBBLE & Co., 2, Serjeants INN, and 40, FLEET STREET, LONDON, make and supply all the various ACCOUNT-BOOKS as approved and adopted by Accountants, &c., to Gas Companies.

A complete set of the Books and Forms forwarded within a few days from receipt of order.

SAMUEL PONTIFEX, Consulting Gas Engineer, having retired from the Great Central Gas Company, is now prepared to furnish PLANS and SPECIFICATIONS, as well as ADVISE Provincial Gas Companies as to the erection of new, or alteration and enlargement of existing works.

Offices: 22, Coleman Street, LONDON, E.C.

ALFRED PENNY, Gas and Consulting ENGINEER,

WENLOCK IRON-WORKS,

21, WHARF ROAD, CITY ROAD, LONDON.

Mr. PENNY having had a large experience in the construction, alteration, and management of Gas-Works, begs to inform the Directors of Gas Companies that he may be consulted on all matters appertaining thereto. He also manufactures Gasholders, Purifiers, and all the various apparatus used in Gas-Works, and keeps in stock Retorts and Mouthpieces, Socket-Pipes, Bends, Branches, and T-pieces, &c., &c.

Plans, Specifications, and Estimates prepared.

BRONNER'S PATENT GAS-BURNERS give 99 per cent. of light, as compared with 27 per cent. given by ordinary burners, with equal consumption of gas.—*Vide* "Gas Referees Report," published June, 1869.

HENRY GREENE AND SON, Sole Consignees of Brönner's Patent Improvements in Gas Lighting, 16 and 17, King William Street, E.C., and 138, Regent Street, LONDON. Agents wanted.

CATHELS & TERRACE'S Patent Four- WAY DISC GAS-VALVE is the simplest and best Valve for Purifiers, and as a By-pass for other apparatus in Gas-Works. It is always gas-tight, and has no springs, ground faces, or other delicate parts. By its use the flow of the gas cannot be accidentally stopped, and it never sticks.

For prices, &c., apply to the Manufacturers, Messrs. GUEST AND CHEIMES, Foundry and Brass Works, ROTHERHAM.

CATHELS'S Patent District Dry Gas- GOVERNOR is the only perfect self-acting contrivance for Regulating the Pressures in the higher levels of a district.

For prices, &c., apply to the Manufacturers, Messrs. GUEST AND CHEIMES, ROTHERHAM.

ALFRED LASS,

ACCOUNTANT,

MERTON ROAD, NEAR HIGH STREET,

WANDSWORTH, S.W.

Mr. Alfred Lass having had considerable experience in arranging, making up, balancing and auditing gas accounts, begs to inform the Directors of Gas Companies that he may be consulted on all matters relating thereto.

Balance-sheets prepared, Accounts audited, Consultations, Agencies, &c.

A CHECK SYSTEM OF BOOK-KEEPING FOR GAS COMPANIES.

"Mr. Charles Hight, Public Accountant, of 26, Budge Row, has brought out a work most useful to Gas Companies, the practical application of which will render frauds impossible. . . . It is based on a principle ensuring the best possible check on the rental and the sales, with a greatly improved method of recording the expenditure. The plan is adapted to the Board of Trade regulations for the form and details of the half-yearly published accounts of the London companies."—*Globe.*

"An admirable plan. . . . Has the merit of simplicity."—*City Press.*

For instructions and forms, apply to NISSEN, PARKER, AND ARNOLD, 43, Mark Lane, LONDON, E.C.

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Registered under the Companies Acts, 1862 and 1867, by which the liability of the Shareholders is restricted to the amount of the Shares subscribed for.

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Of which 10,000 are now offered for Subscription.

DEPOSIT ON APPLICATION, 10s. PER SHARE. PAYMENT ON ALLOTMENT, 10s. PER SHARE.

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JAMES MILNE, Esq., Gas Engineer, 57, Gracechurch Street, London.
JOHN BROWN, Esq., Woodford, Essex, and Gresham Place, London.

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CONSULTING ENGINEER—DAVID MURRAY, Esq., C.E., 32, Great George Street, Westminster.
AUDITOR—GEORGE WHIFFIN, Esq., Accountant, 8, Old Jewry, London.
SECRETARY—Mr. ISAAC DODS.

Temporary Offices—39, LOMBARD STREET, LONDON, E.C.

Messrs. TAYLOR, CAMERON, & CO. are authorized by the Directors to offer for SUBSCRIPTION 10,000 SHARES in SYMES'S PATENT ECONOMIC GAS COMPANY, Limited, an undertaking which places cheap gas within the reach of both town and country consumers.

This Company has been formed for the purpose of acquiring and working Symes's Patent for the manufacture of Gas in the United Kingdom.

This invention meets a long-felt want, and will supply gas to those who avail themselves of it at a cheapness of cost hitherto unattained by any other known method. The usual price of gas ranges from 3s. 6d. to 5s., and sometimes 6s. per 1000 cubic feet—companies having to provide for waste and interest upon the large capital expended upon miles of piping, requiring constant repair and periodically entire renewal, to say nothing of rent, rates, taxes, and other heavy working expenses.

Whereas, by Symes's Patent, lengthened pipes are unnecessary, and, save the moderate outlay upon putting up the apparatus, heavy expenses are avoided, and the gas can be made for a sum not exceeding 1s. per 1000 cubic feet, if made from slack, and 2s. 2d. if made from coal. (See Report No. 1, appended.)

The apparatus is chiefly designed for the purpose of supplying gas to isolated buildings, such as railway stations, country houses, factories, churches, hotels, public schools, and to ships, lighthouses, &c., &c., and provides a simple, safe, and inexpensive means of making pure and cheap gas, with very little trouble, and very small outlay in the application of the apparatus.

The cost of an apparatus to sustain 25 lights will depend in some measure on the form of gasholder introduced, but from those already erected it has been estimated that the first cost will not exceed 20s. to 25s. per light up to 30 lights, and this rate will be decreased as the number of lights are increased. It is further calculated that 25 lights full on will require 3 cubic feet of gas per hour, and basing a calculation on 25 lights full on, it will be seen that to sustain them burning six hours per day 450 cubic feet must be provided, and the cost to the consumer of this quantity, by using the aforesaid apparatus, will be about 6d., if made from slack, and about 1s. 1d. if from coal.

The space required for the retort is so small that it can be placed in any private dwelling-house without occasioning more inconvenience than an ordinary stove.

The extreme simplicity of its construction is such that any local gas-fitter can erect it, and, if necessary, regulate it with the greatest ease. It can be managed by any domestic servant without interfering with ordinary duties. It is free from smell, and perfectly safe, being provided with safety-valves, which render accidents impossible.

Refuse coal, dross, wood, bones, peat, &c., will suffice for the manufacture of the purest gas, so that this apparatus will be invaluable in districts where coal does not abound; and as, in these cases, the cost of gas ranges frequently from 14s. to 21s. per 1000 cubic feet, the advantages to such localities are incalculable.

It can be adjusted to serve without additional fuel for the cooking purposes of any household, and also to distribute hot air throughout the premises simultaneously with the manufacture of gas.

The illuminating power of the gas produced by Symes's apparatus is equal to 18½ candles. (*Vide* reports of Messrs. E. L. Rumble and David Murray, appended.)

An important feature in this invention is the simplicity and completeness of the patent door for closing the retort, as it does away with the clumsy, ineffective, and expensive system of what is termed "luting"—that is, plastering up the door of the retort with lime, &c., to prevent the escape of gas during the process of generating it—involving large companies in heavy expenditure. It is equally adaptable to all processes of gas manufactory, and will of itself yield a large revenue should existing companies avail themselves of it.

A contract has been entered into between Wm. Baird of the one part, and Col. Robert Pitcairn, on behalf of the Company, of the other part, for the purchase of the patentee's rights for the sum of £10,000 in cash, and £10,000 in fully paid shares of the Company.

A number of apparatuses have already been constructed, and further orders have been received, which are now in process of execution, and the profits derived from these orders will accrue to the Company.

It is difficult to estimate precisely a scale of profits in carrying out this patent, as these will depend upon the number of apparatuses manufactured by the Company, and the amount of royalties to be obtained; but, as further orders are coming in daily, the following results may be reasonably anticipated:—

Estimate, say, 1000 apparatuses per annum, at a profit of £10 each	£10,000
Royalties, say	5,000
	£15,000

Or equal to 50 per cent. on the amount of called-up capital; and this may fairly be expected to increase as the utility of the invention becomes more generally known.

Symes's patent may be seen in full operation at the Mansion House Buildings, Queen Victoria Street, nearly opposite the Mansion House.

The Memorandum and Articles of Association, with copy of contract and specification of patent, may be inspected at the Offices of the Company.

Applications for shares, accompanied by a deposit of 10s. per share, will be received by the Bankers, or by Messrs. Taylor, Cameron, and Co., 39, Lombard street, E.C.

Prospectuses, with reports and printed forms, may be obtained at the Company's Offices, or from the Bankers of the Company, and from all London and provincial stockbrokers.

In event of no allotment being made, the amount paid on deposit will be returned without deduction.

REPORTS.—No. 1.

56, Montpelier Road, London, S.E., Dec. 8, 1871.

To the Directors of "Symes's Patent Economic Gas Company, Limited."

Gentlemen,—I beg to inform you that I have inspected Symes's Patent Gas Apparatus, and, having devoted some time to the matter, am pleased to testify as to its economy and effectiveness in working, durability, and fitness for country mansions, manufactories, farm buildings; also warming houses, &c. The simplicity and yet completeness of the apparatus, the facility afforded for cleaning out the connexions, the perfect collection and delivery for the overflow of the tar, &c., the admirable way of forming the door for closing the retort without luting, and the mode of working, is certainly excellent, and can with perfect safety be used in houses without the slightest danger ever occurring, it being specially provided with the necessary safety-valves. There is another item I consider of importance—namely, should any renovation be required (after wear), it can readily be done by an ordinary gas-fitter.

The result of my analysis, as made by the Patent with common coal (sold at 18s. per ton, retail), and 10 per cent. of cannel coal, was as follows:—

4·08 cubic feet of gas from 1 lb. of coal; 12 per cent. of hydrocarbons, with no sulphuretted hydrogen, carbonic oxide, nor ammonia; in fact, free from all impurities. With regard to the illuminating properties of the same, I found it according to Lowe's Jet Photometer to be equal to 18½ candles, temperature being 62° Fahr., which is in every way satisfactory. The cost of the gas would certainly not exceed 1s. per 1000 cubic feet when made from slack; but if coal is used, it would necessarily increase it to 2s. 2d. These items I have obtained from actual experiments made at various times with Symes's Patent. In conclusion, I must say I am well satisfied with it, and am confident when brought before the public it cannot fail to be of great service to them, and prove worthy of their support.—I have the honour to be, Gentlemen, your obedient servant,

E. L. RUMBLE.

No. 2.

32, Great George Street, Westminster, Dec. 9, 1871.

The Directors, "Symes's Patent Economic Gas Company, Limited."

Gentlemen,—I have inspected and tested "Symes's Patent Gas Apparatus."

I am well satisfied that the arrangements are very good, and well calculated to meet the pressing demand for supplying outlying hamlets, villages, and factories, both at home and the colonies.

The apparatus is very handy, and the cleaning out of the connexions very simple and easy.

The overflow of the tar, as regards collection and delivery, is also simple and good.

The mode adopted in the design of the door for shutting up toe retort is very effective and safe, and can be used anywhere without danger in any houses or premises.

The safety-valves are ample to prevent any accident.

I estimate that gas can be made from ordinary coal for about 2s. per 1000 feet, or of good knobble-coal slack with an admixture. If fine or cannel be used, the cost of production would be about 40 per cent. less. I am taking London prices of coal as a basis; therefore, in certain localities, the prices would be even less.

With respect to the manufacturing power, I make it equal to 19 candles, with a fair average temperature of say, 60° Fahr.

I need only add that the distinctive features of the apparatus are simplicity, safety, economy in production, and the small loss of gas in consumption, and that the apparatus can be repaired when needed by any ordinary gas-fitter.

The compactness of this apparatus cannot fail to recommend itself, and be largely adopted by the public when known.—Yours truly, DAVID MURRAY.

FORM OF APPLICATION FOR SHARES.

To the Directors of "SYMES'S PATENT ECONOMIC GAS COMPANY, LIMITED."

Gentlemen,—Having paid to your Aankers the sum of £ , being a deposit of 10s. per share on shares in the above Company, I hereby request that you will allot me that number, and I agree to accept the same, or any less number you may allot me, and to pay to you 10s. per share on such allotment; and I request that my name may be placed on the register of shareholders for the shares so allotted.

Name in full.....
Residence.....
Profession or Business .....
Date.....

SYMES'S PATENT ECONOMIC GAS COMPANY, LIMITED.

NOTICE IS HEREBY GIVEN, that the LIST of APPLICATIONS for SHARES in the above Company will CLOSE for London on WEDNESDAY, December 20, and on THURSDAY, December 21, for the Country.

TAYLOR, CAMERON, & Co.

39, *Lombard Street, London, E.C., Dec.* 18, 1871.

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FOR REMOVING THE
CARBONACEOUS INCRUSTATION FROM GAS-RETORTS.

Testimonial of Mr. W. Ford, Engineer of the Stockton Corporation Gas-Works.

"Dear Sir,—In reply to your inquiry as to my experience of Edge's patent method for removing the Carbonaceous Incrustation from through Retorts, I have much pleasure in expressing my thorough appreciation of the process; it has been the means of saving our stokers many hours hard work, and the Retorts much serious destruction.—I am, dear sir, yours truly, "W. FORD.
"To E. Goddard, Esq., Ipswich."

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PATENT FIXED WATER-LINE GAS-METERS,
Which are uniform with the ordinary Meters, and register with minute accuracy.
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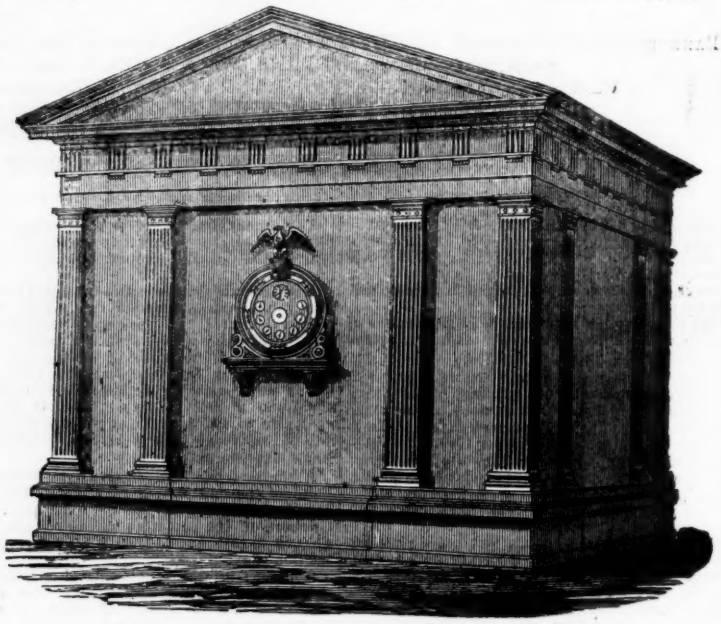

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PLANS and ESTIMATES furnished and Gas Companies advised on improvements, extensions, and alterations of works.

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Is guaranteed to prevent and arrest Rust on all Ironwork, and to cover Tar most effectually. It is most valuable for protecting it from the action of salt water, rain, sulphurous and gaseous exhalations. It has been well tested at various Gas-Works, in covering Tar on Gasholders, Purifiers, &c., and has given great satisfaction. Sample cans for trial sent free of charge. All communications to be addressed to

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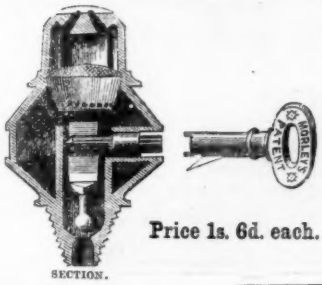

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Extract from Report by Dr. Letheby:—

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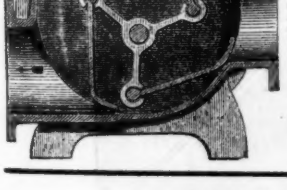

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JOURNAL OF GAS LIGHTING.—Subscribers who have SPARE COPIES of the following Numbers may obtain the FULL PUBLISHING PRICE of same on sending them to Mr. W. B. KING, 11, Bolt Court, Fleet Street, LONDON; they being required to complete sets.
Nos. 397, dated January 7, 1868.
" 423, " January 5, 1869.
" 461, " June 7, 1870.

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"This pamphlet, which we have read carefully, is calculated to convince the most sceptical as to the saving to be effected from the use of gas for the purposes advocated by the author, whose well-known reputation as a scientific engineer stamps his opinions on the subject with a high value. In this instance, moreover, details and proofs are cited which render his position impregnable, and entirely remove theories into the domain of facts."—*The Freemason, Oct.* 28, 1871.

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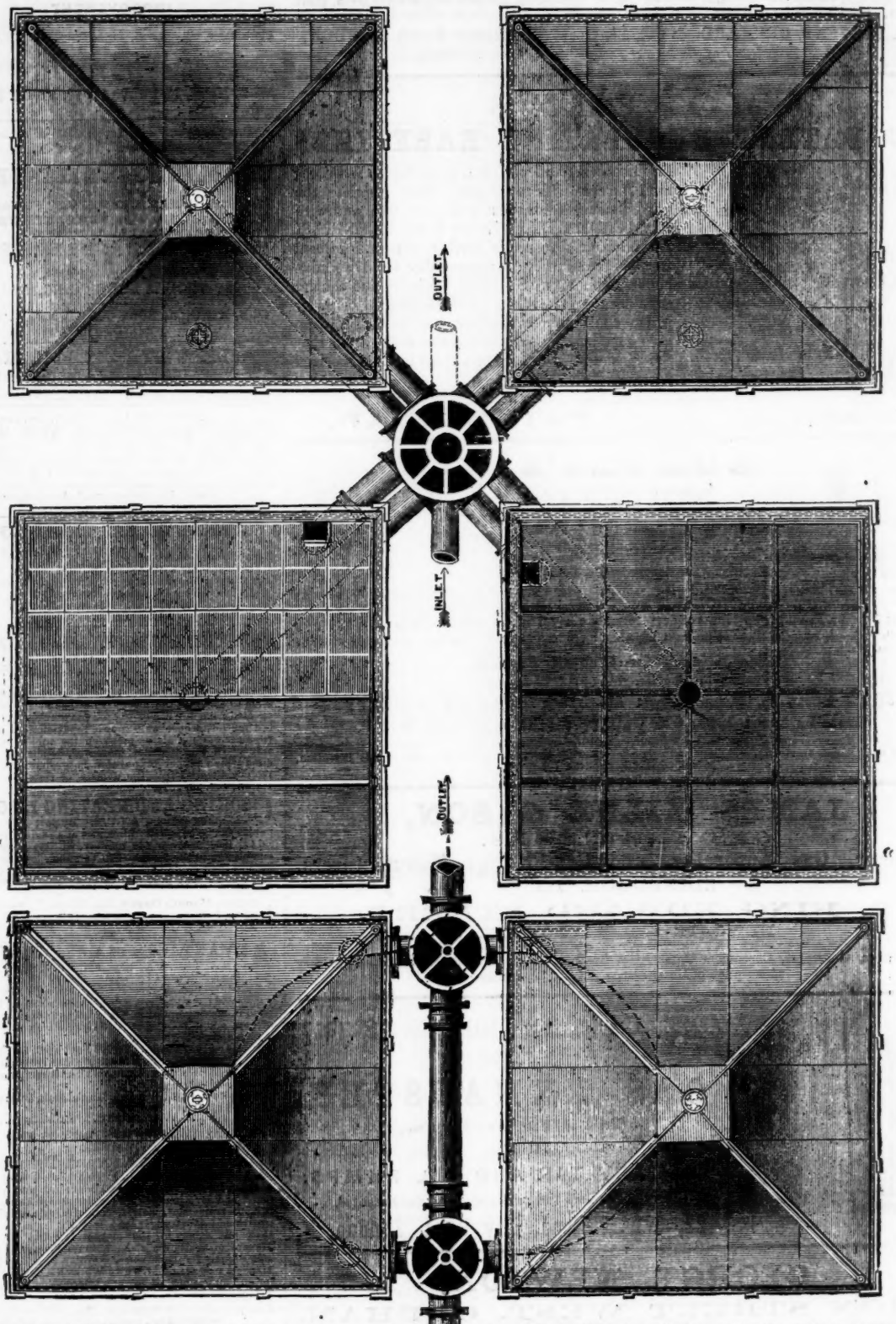
C. & W. WALKERS' IMPROVED PURIFIERS,

WORKED BY THEIR PATENT CENTRE-VALVES, &c.



These Purifiers will develop the largest amount of purifying power, and effect the most perfect purification of gas. The upper engravings show four Purifiers fixed in square, worked by our patent centre-valve, and the lower, the mode of working two Purifiers only by the four-way centre-valves. The centre-valve for working them is perfectly protected from all injury inside the safety cover. The working of these valves is so easy and so governed by the stop-catch movement that the Purifiers can be instantaneously changed with marvellous ease and certainty, even in the dark. The simple straight connexions cannot fail to be at once observed. The lifting apparatus is the most perfect for work, and one man can lift and travel a purifier-cover of any size. The floor of the purifying-house is clear and level, so that a tramway can be laid down if required for charging and discharging the Purifiers. The wood sieves also are very superior, and distribute the gas to be purified evenly all over the surface of the purifying materials. The facings to these valves are *accurately scraped*, metal to metal, to perfect surfaces, absolutely true, without any grinding, and by the patent surfaced bar facings, they never remain uncovered or exposed to dirt or rust. There is nothing more durable upon a Gas-Works, when once scraped perfectly true. They remain as tight in 20 years as the first day they are put into use.

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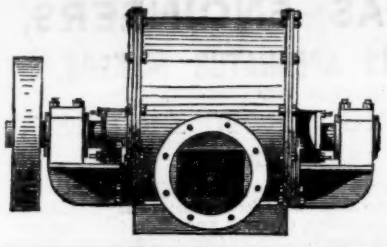

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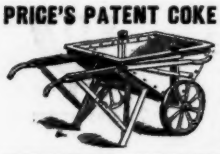

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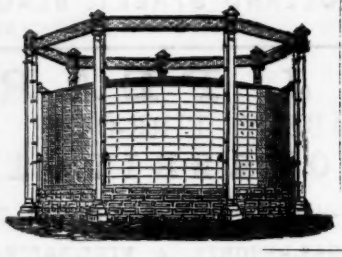

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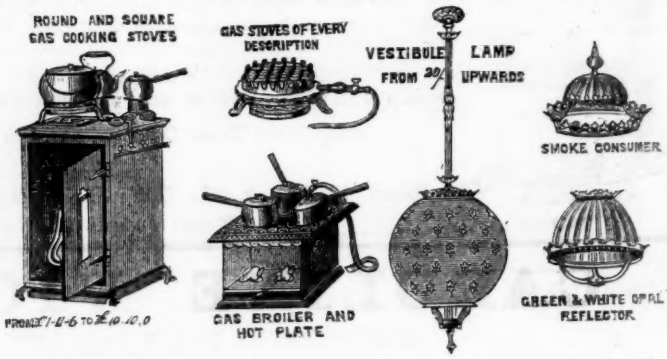
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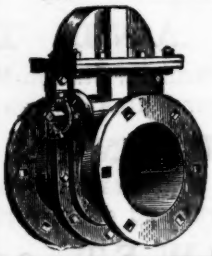

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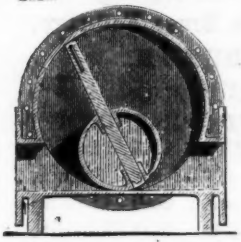

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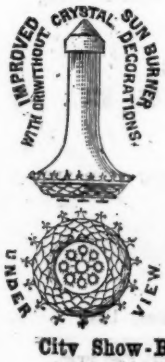

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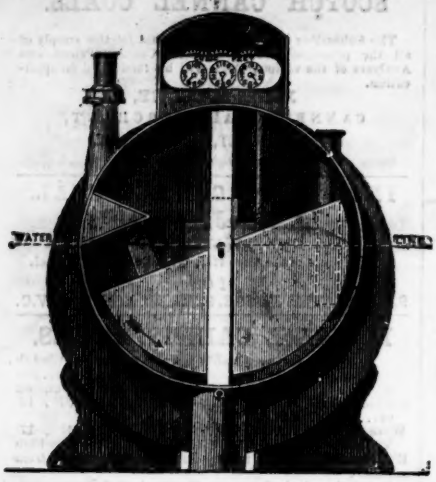

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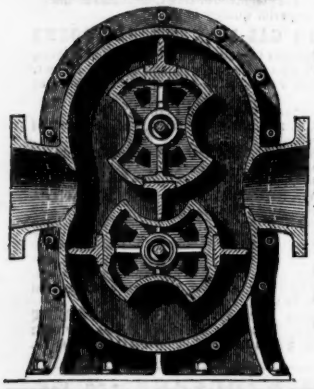

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